



SCIENCE SKILLS & THRILLS

ARVIND GUPTA



BEST OF ARVIND GUPTA  
**SCIENCE**  
**SKILLS & THRILLS**  
ILLUSTRATION: VENKI



KERALA STATE INSTITUTE OF CHILDREN'S LITERATURE

*First Edition* February 2008      ISBN 978- 81- 906266- 1- 3      SI No: 562/ E1      Rs: 100.00

**Science Skills and Thrills** (*English*)  
Activity

This edition © *illustration & design* Kerala State Institute of Children's Literature, Thiruvananthapuram.

© *text* Arvind Gupta  
Illustration & Design Venki

Published by Rubin DCruz, Director, Kerala State Institute of Children's Literature  
Sanskrit College Campus, Thiruvananthapuram, Kerala 695034  
Editor B Prasad

All rights reserved. No part of this book may be reproduced or used in any form or by any means -  
graphic, electronic or mechanical - without the prior written permission of the publisher.

Printed at  
Akshara Offset, Thiruvananthapuram 695 035



BEST OF ARVIND GUPTA  
**SCIENCE**  
**SKILLS & THRILLS**

ILLUSTRATION: VENKI



KERALA STATE  
INSTITUTE OF CHILDREN'S  
LITERATURE

## CREATIVITY THROUGH READILY AVAILABLE MATERIALS

The whole world  
is a garbage pit,  
Collect some junk  
and make a kit.



All children like to  
rip open toys and  
see what is inside.  
The best thing a  
child can do with a  
toy is to break it.



I can barely  
complete the  
curriculum. Where  
is the time to do  
experiments?



Where is the  
money to buy  
science kits? With  
sixty children  
doing experiments  
I will go bonkers.



Serious teachers have always raised such questions. These are legitimate concerns. With paucity of funds and poor infrastructure - how does one do justice to activity based science? There is enough evidence the world over to show that ready made kits gather dust. The models the children and teachers make themselves remain more enduring. There are amazing possibilities of doing creative science using simple, readily available materials.

The Second World War saw several countries devastated. Under severe economic hardships many poor countries reconstructed school buildings. But then they had little money left to set up science laboratories - which were expensive to set up. In the late 1950's J. P. Stephenson a British teacher wrote a book showing the possibilities of doing process based science using utterly simple materials.

The title of the book was **Suggestions for Science Teachers in Devastated Countries**. This book took the world by storm. It showed that expensive, fancy equipment were far removed from the lives of ordinary children - in fact very alienating. Unesco





agreed to widen and deepen the scope of the book and thus came out the famous **Unesco Source Book for Science Teaching** - the bible for science activities. In 1963, this book was translated in Hindi, Marathi, and some other regional languages. The vernacular editions have unfortunately been out of print for decades.

Inspired teachers don't get bogged down by rules and regulations. The weighty state curriculum does not cow them down. Instead, they carve out a special niche for themselves. They have faith in the resources and resilience of children. The limitation of the chalk-and-talk method are well known. They know that "activities" constitute great learning and children love them. They involve children as partners in organizing activities. They inspire children to recycle, reuse, reinvent waste into joyous toys and simple science models.

This is my twelfth book on science activities. All my books have been digitized. They can be easily downloaded. I can't print photographs in my books because they will make them expensive. But there are 1000 coloured photographs of TOYS FROM TRASH on my web site. All these and several other interesting books on science activities, education and peace can be downloaded for free from my website:

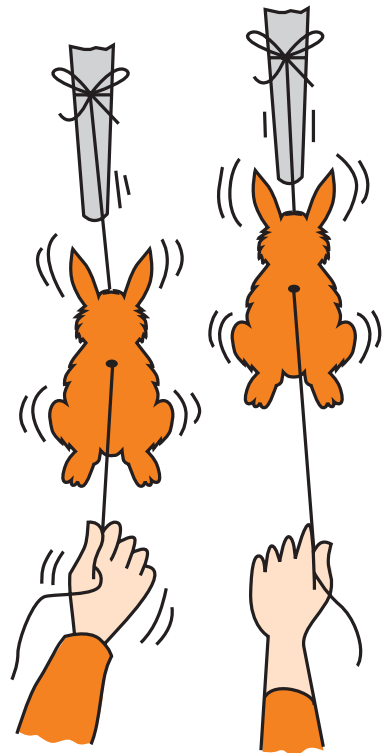
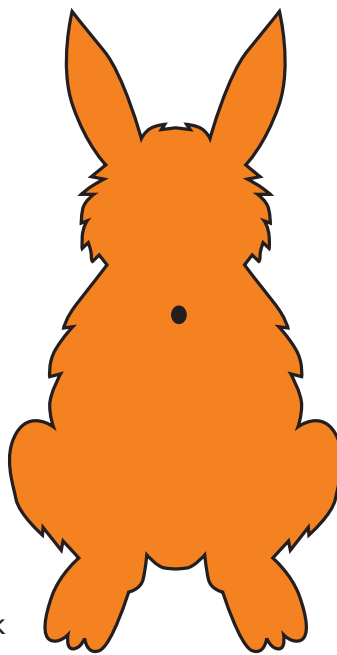
<http://arvindguptatoys.com>

**Arvind Gupta**

# RABBIT RACE

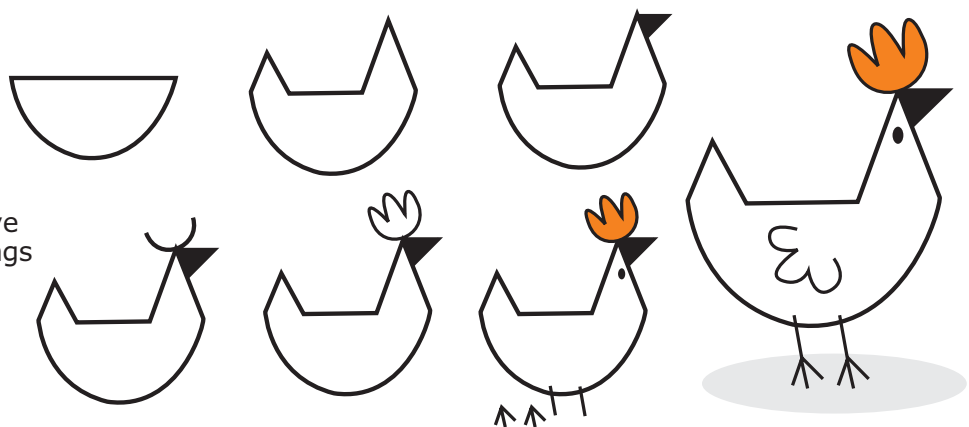
You will need 2 pieces of cardboard about 25 cm long, pencil, scissors, sketch pens and two 30 cm pieces of string.

Cut two rabbits from heavy cardboard, using the pattern shown in the picture. Colour the front and back of the rabbits using sketch pens. With a pencil make a hole through the middle of each rabbit just below the head. Make a neat hole with smooth edges. Tie a piece of string through the hole of each rabbit. Tie one end of each string to the leg of a table, just high enough so that the rabbit's legs touch the floor. Back up, taking the rabbits with you, to the end of the string. Make the rabbits stand up and lean a bit towards the table. When you jerk the string, the rabbits will walk towards the table. These rabbits walk best on a smooth floor. The first rabbit to reach the leg of the table will be the winner.



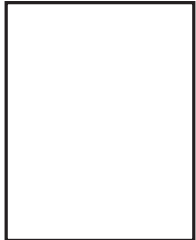
# EASY TO DRAW

Drawing basic and simple shapes. Observe your surroundings and try some new shapes.

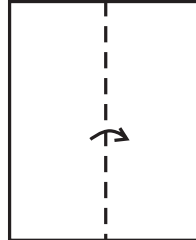


# BIRD OF PEACE

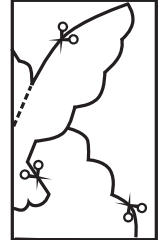
A very elegant bird of peace can be made from a piece of stiff paper.  
This exquisite bird stands like a piece of sculpture.



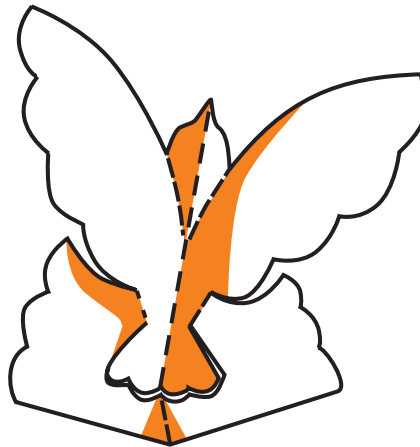
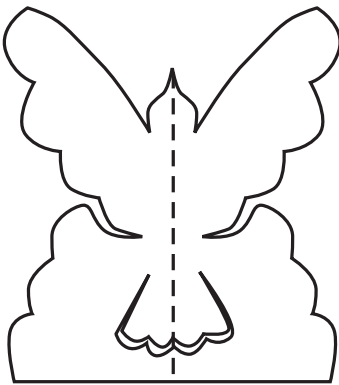
1. Take a thick 30 cm x 15 cm paper.



2. Fold it in half.

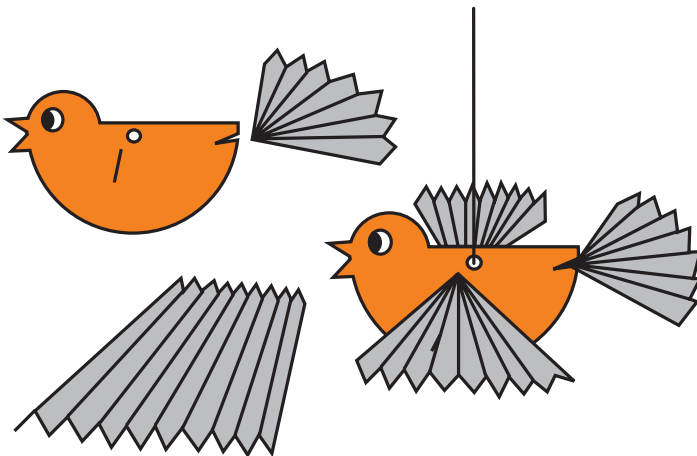


3. Mark out the bird of peace and cut only on the solid lines. Do not cut the dotted lines.



4. Fold along the dotted lines and then make the bird of peace stand on its base.

# CARDSHEET BIRD



Cut out the body and head of the bird from cardboard. Colour both sides of the body with crayons. Paint the eyes with bright colours.

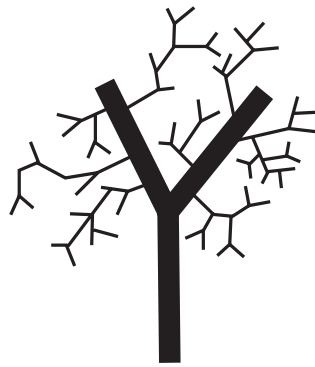
Cut a slit through the body near the shoulders for the wings. Make another small slit at the rear for the tail to be slipped and glued in position. Fold coloured paper in an accordion shape to make the wings. Tuck the wings and glue the tail. Then hang the bird with a thin string.

# LETTER Y TREE

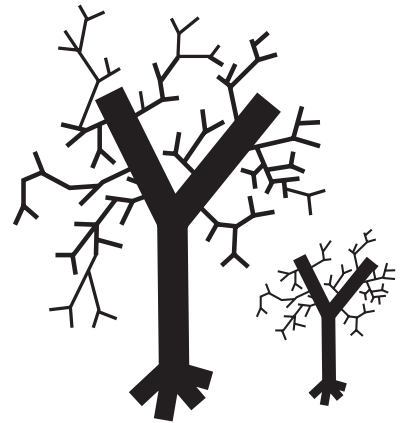
Stand up and stretch your arms to the sky. You are like a tree with a trunk and branches. Trees are easy to make if you start with the letter Y.



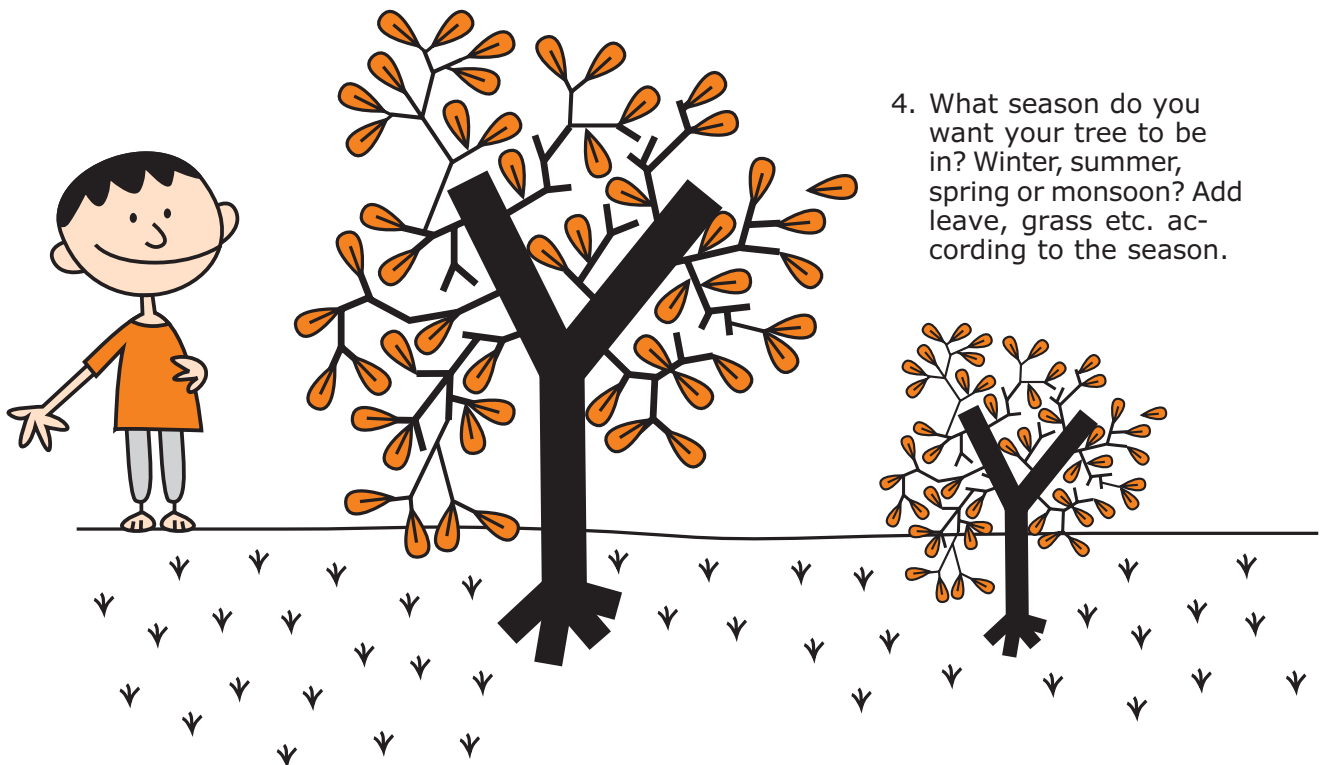
1. Use a thick sketch pen (preferably of brown colour) to make a Y that is as tall as your paper.



2. Make lots of small Y shaped branches in the tree. Some branches will be sideways, others will be upside down. The Y's will become smaller and smaller as you proceed and go towards the end of the branches.



3. Anchor your tree trunk to the ground by giving it roots. Make another small Y tree in the background. Does it look further away?



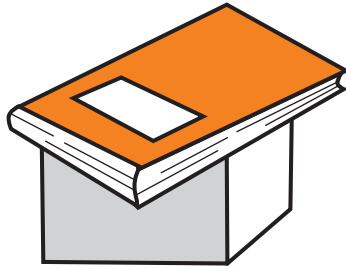
4. What season do you want your tree to be in? Winter, summer, spring or monsoon? Add leave, grass etc. according to the season.

# PAPER STRUCTURES

By simple experiments you can learn a great deal of paper engineering.

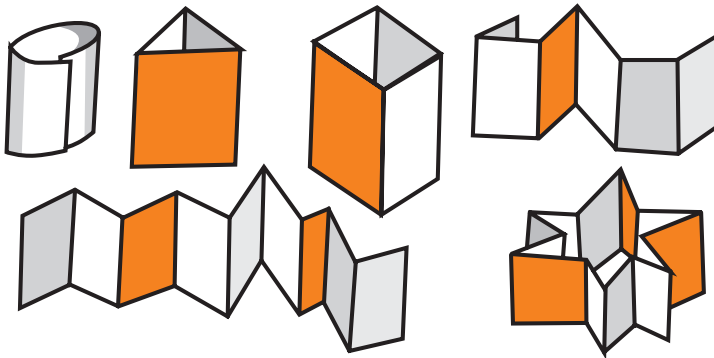


1. Fold a sheet of paper in a 'V' shape and stand it on its edge.



2. Place a book on top. Will it support the weight of the book?

Maybe, the paper will hold its weight, but crumples when more weight is added.



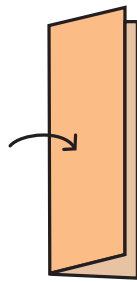
3. Can you fold another sheet in a different way so as to support the weight of the book? The illustrations show a few ways of doing it. Once you have folded several sheets into shapes that will support the book, there is still one other investigation you should make. Will all the structures be equally strong?

4. One of the ways of testing a structure is to keep loading the structure until it crumples or collapses. This gives us an inkling of the strength of the structure. You will find that one method of folding will support more books than another. By trial and error you will be able to decide that one structure is really stronger than all the others. So, keep piling more and more books until the structure gives way. Once I folded a postcard (14 cm x 9 cm) into a 9 cm high cylinder. Then I loaded it with books. To my surprise the postcard cylinder could support a load of 4 kgs without crumbling!

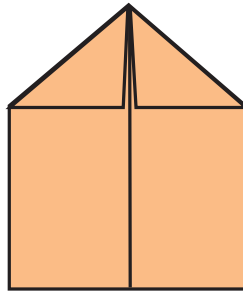


# PAPER AEROPLANE

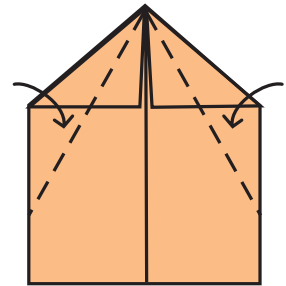
Make a simple aeroplane to understand the various forces acting on it during flight.



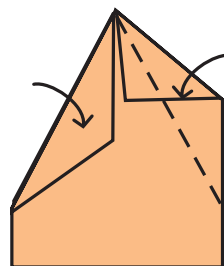
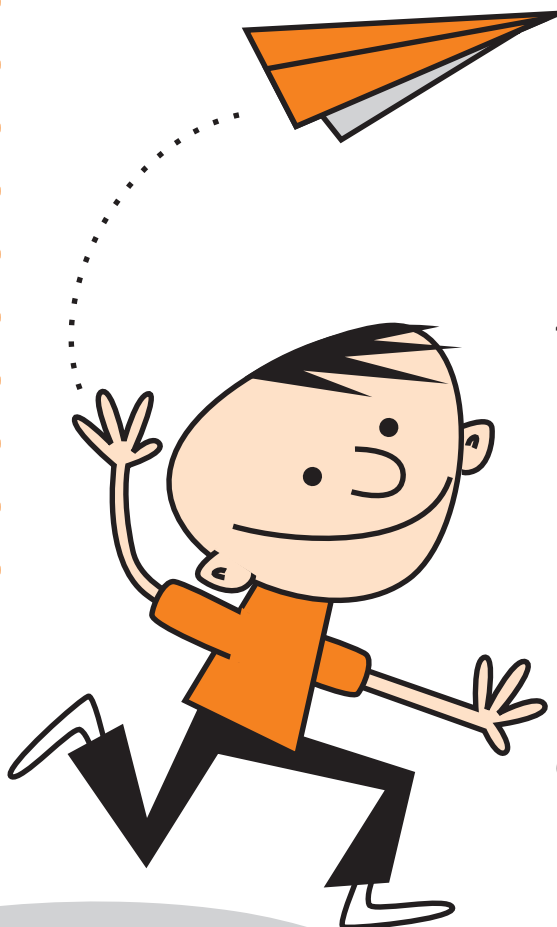
1. Take a sheet of Xerox paper 21.5-cm x 28-cm. Fold the paper in half along the length.



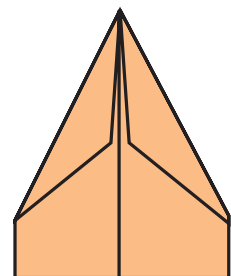
2. Open the paper and fold both corners down towards the centre.



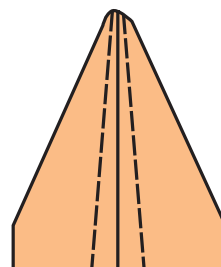
3. Fold one side again towards the centre along the dotted line.



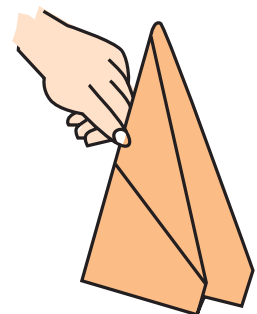
4. Fold the other side along the dotted line.



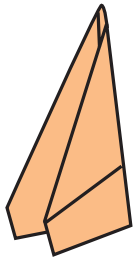
5. Make sure the folds are sharply creased.



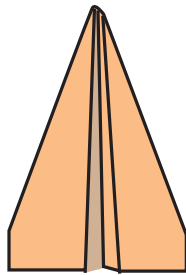
6. Turn the paper over.



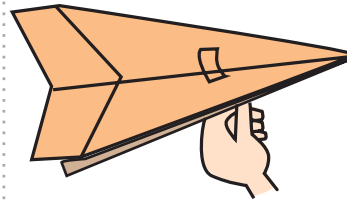
7. Fold one side over along the left-hand dotted line.



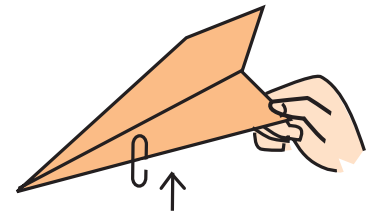
8. Fold the other side over along the right hand dotted line.



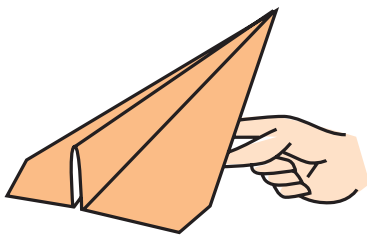
9. From the bottom the plane should look like this.



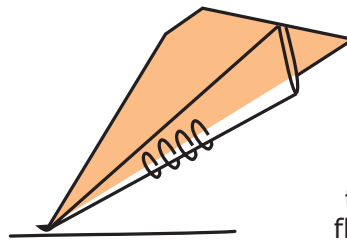
10. Use a piece of cello tape to hold the body of the plane together. Give its wings a slight upward tilt.



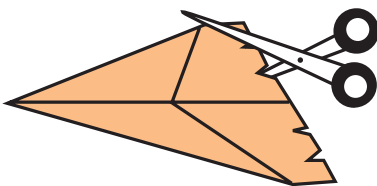
11. Launch your plane. Try increasing its thrust by throwing it harder. If the plane flutters and slips from side-to-side try putting a paper clip.



12. The position of the paper clip changes the point at which the plane's weight is balanced. This point is called the centre of gravity. To find the centre of gravity of your plane try to balance it on one finger. The plane's centre of gravity is where it balances on one finger.

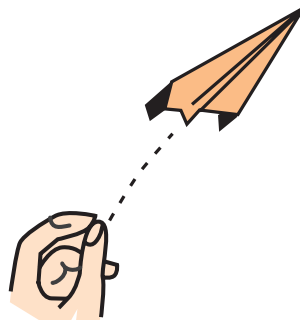


13. What happens to the position of the centre of gravity if you add a paper clip? Where should you place the paper clip for the longest flight? Adding a paper clip not only changes the plane's balance point but also adds to the plane's weight. Try putting two paper clips in the same position. Does the plane stay up in the air as long as with one clip? Try adding three paper clips. What happens now? What would happen if you put 8 paper clips? Real aeroplanes are made of lightweight metals. Planes must also have their cargo carefully balanced before take off.

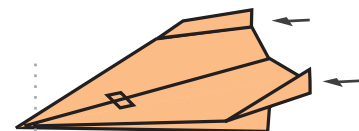


14. Throw your plane into the wind and then try throwing it with the wind. Compare the two flights. In which direction does the wind seem to give the plane more lift? Which way does the flight last longer?

Real planes try to take off and land into the wind. Why? Try making two 1.3 cm cuts 3.5 cm apart in the back edge of each wing. Fold the paper between the cuts at a slightly upward angle.



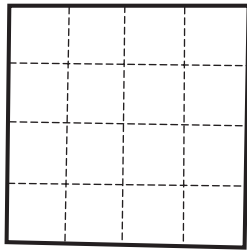
15. These flaps will help the plane go up or down. Launch the plane with the flaps at an upward angle. Do the flaps change the flight of the plane? Flatten the flaps and check. The flaps change the direction of the flight. As the plane moves through the air, the flaps push against the air. With an equal force, the air pushes back against the flaps.



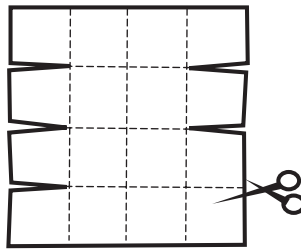
16. Make another aeroplane model. Fold the edges of the wings upwards about 2.5 cm from the ends. The fold should be parallel to the plane's body and at right angles to the surface of the wings. These right-angle folds act as vertical stabilizers. A vertical stabilizer makes the plane fly level and helps stop side-to-side swaying. The wings of the plane act as horizontal stabilizers. They help prevent bumpy, up-and-down movement.

# PAPER HOUSE

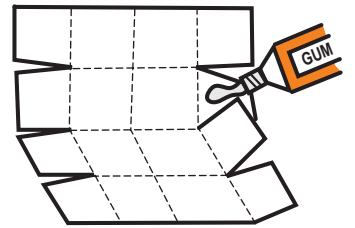
Using paper make houses of different sizes.



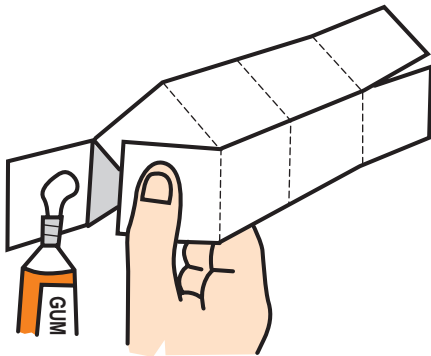
1. Take a stiff square paper with an edge length of about 20 cm. Fold 16 small squares in it.



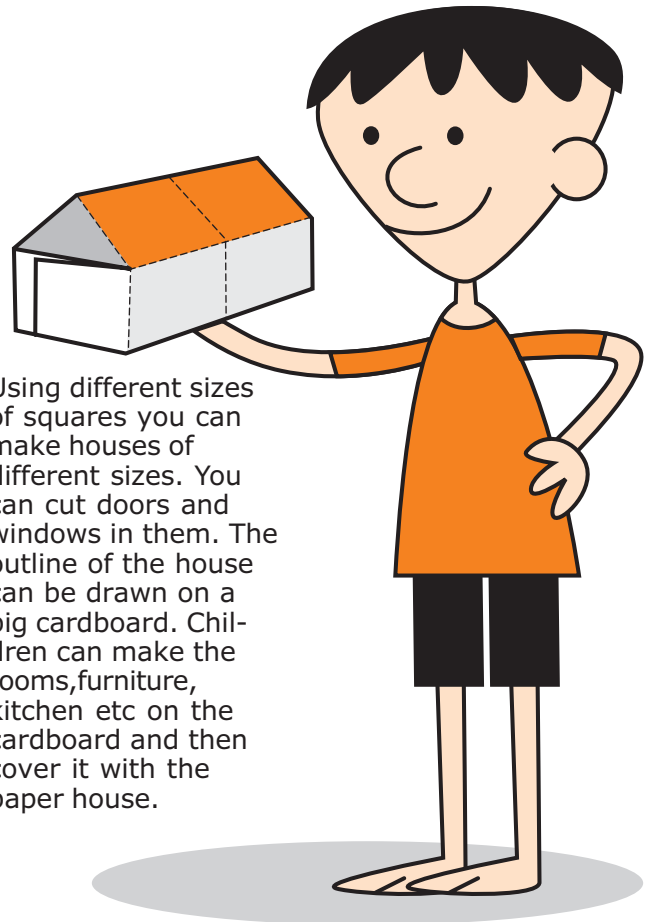
2. Cut along six quarter lines as shown.



3. Put one middle square exactly on top of the other and stick them with glue. They will make the triangular roof of the house.



4. Stick the two end squares to make the side wall of the house. Do the same on the other side to complete the house.

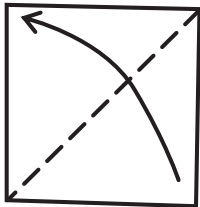


5. Using different sizes of squares you can make houses of different sizes. You can cut doors and windows in them. The outline of the house can be drawn on a big cardboard. Children can make the rooms, furniture, kitchen etc on the cardboard and then cover it with the paper house.

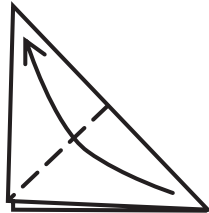


# RABBIT

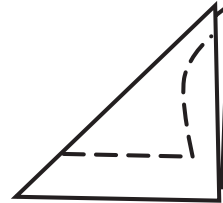
Create an ear - flapping rabbit.



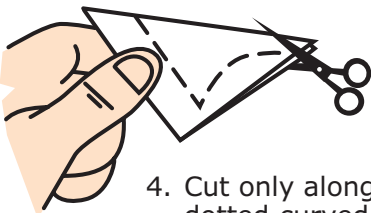
1. Fold a 10 cm edge length square along the diagonal to make a triangle.



2. Fold this big triangle into half to make a small triangle.

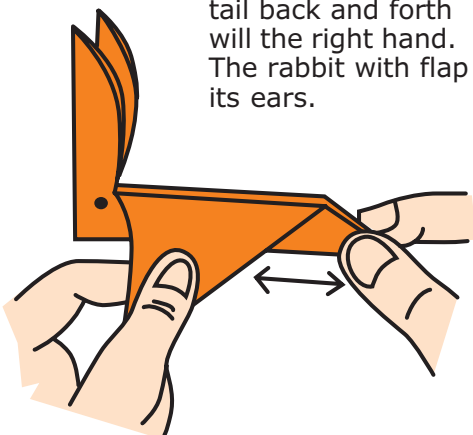


3. This small triangle will have a 'V' shape. Draw the ears of the rabbit with a curved dotted line.



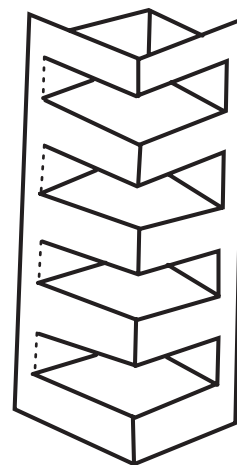
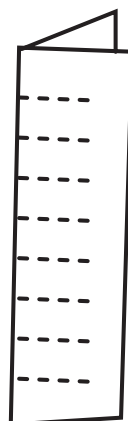
4. Cut only along the dotted curved line to make the ears of the rabbit.

5. Fold along the straight dotted line to make the front legs of the rabbit. Hold the rabbit with the left hand as shown and move the tail back and forth with the right hand. The rabbit will flap its ears.



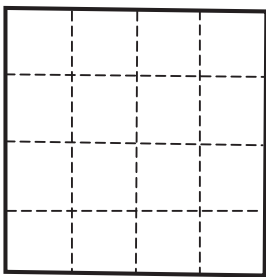
## SELF STANDING SHELF

Fold a rectangular sheet of paper in half. Make cuts in the margin and fold the cut strips back to make a pretty pattern. You can make this shelf stand.

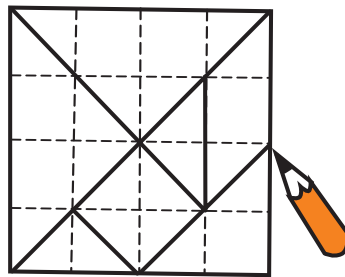


# TANGRAM

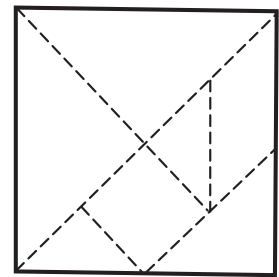
Tangram is a thousand year old Chinese puzzle. In this a square is cut into seven pieces. Then all the seven pieces are joined together to create different patterns - geometric designs, humans, birds, animals. All the seven pieces have to be used for each design. There are thousands of different designs to make.



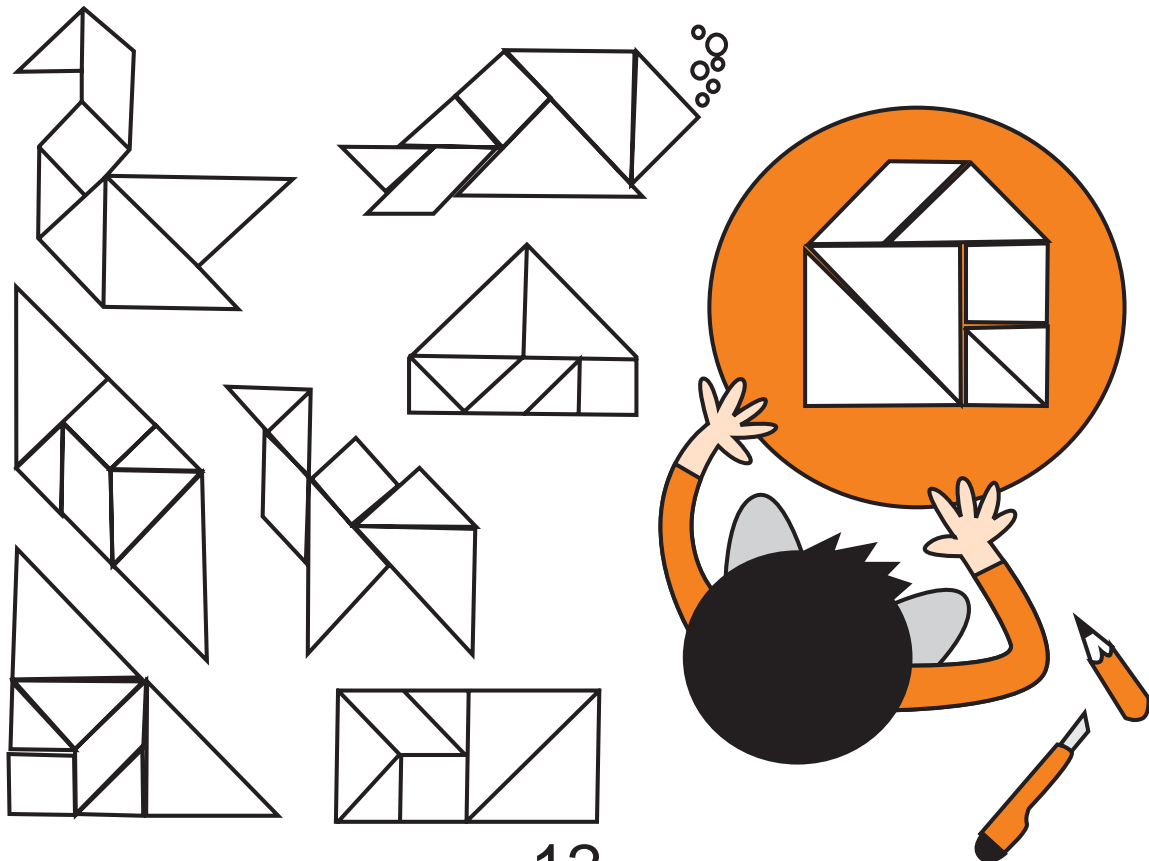
1. Mark 16 small squares in a cardboard square of edge 10 cm.



2. Draw the lines as shown.

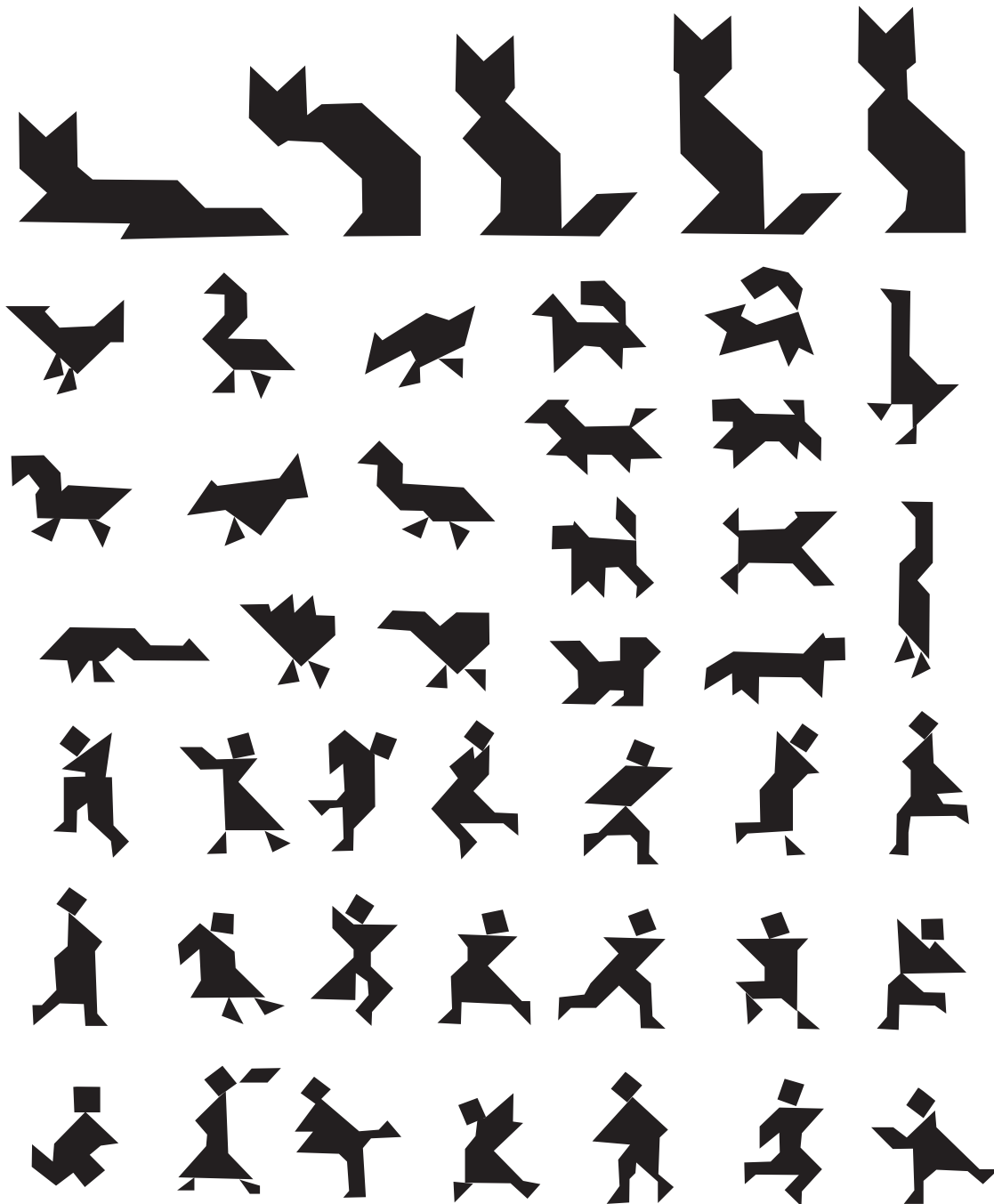


3. Cut along the lines and you have the seven pieces of the Tangram.



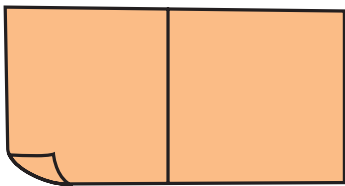
# TANGRAM

Try different forms using all 7 pieces every time.

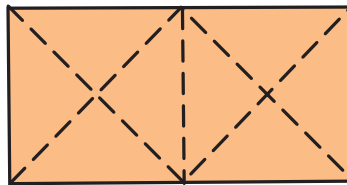


# JUMPING FROG

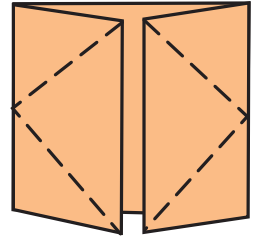
This is an amazing paper toy. It needs a special size of rectangular paper where the length is double the width. The frog has a special spring folded from the paper itself. When you press the spring it makes the frog leap and jump.



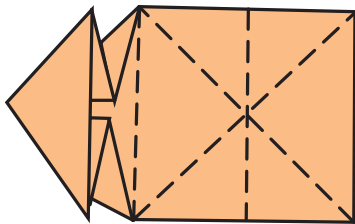
1. Take a 10 cm x 20 cm rectangular sheet of paper. Fold two squares in it.



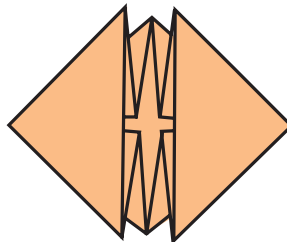
2. Fold criss-cross diagonals in both the squares. All the four creases should be in the same direction.



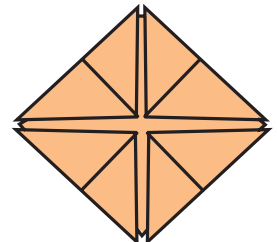
3. Reverse the paper. It will look like two hillocks. Fold the edges of the hills to the midline.



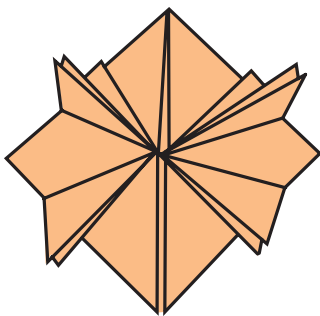
4. Reverse the paper. Tap the centres of both squares to get two cups. Push to make a triangle.



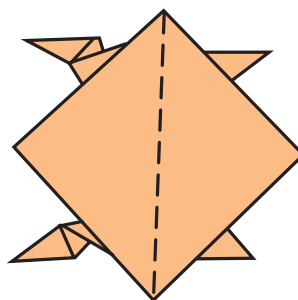
5. Repeat the same for the right side.



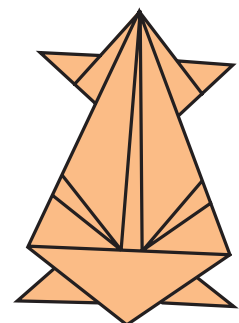
6. Bring all the four standing triangular ears to the left and right hand side corners and crease.



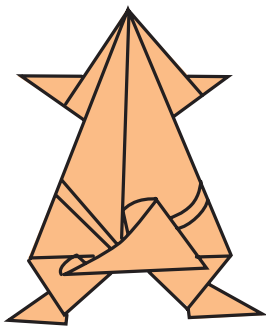
7. Bisect the internal angles To make the legs jut out.



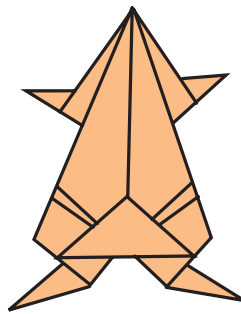
8. The model when reversed looks like a tortoise. Crease its backbone.



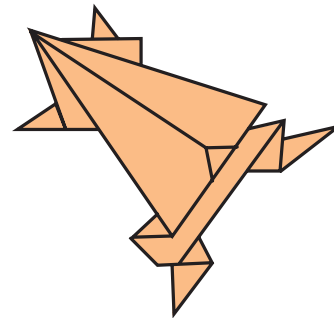
9. Crease the left and right hand edges of the diamond shape to the backbone.



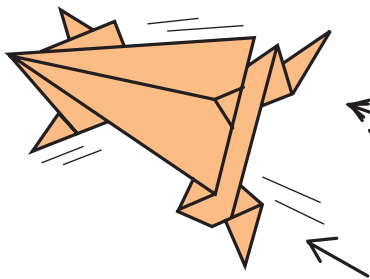
10. Fold the base triangle upwards, and insert the left flap in the pocket of the triangle to make a lock.



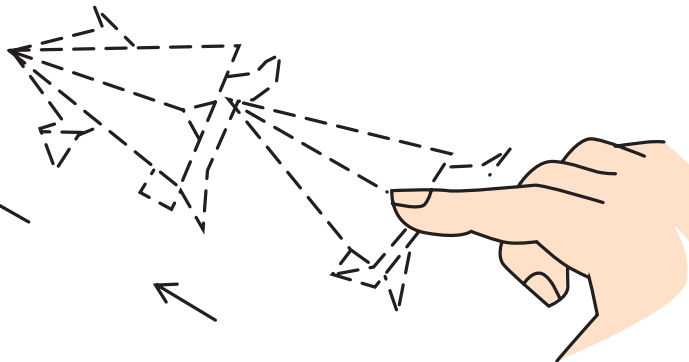
11. Similarly, lock the right flap.



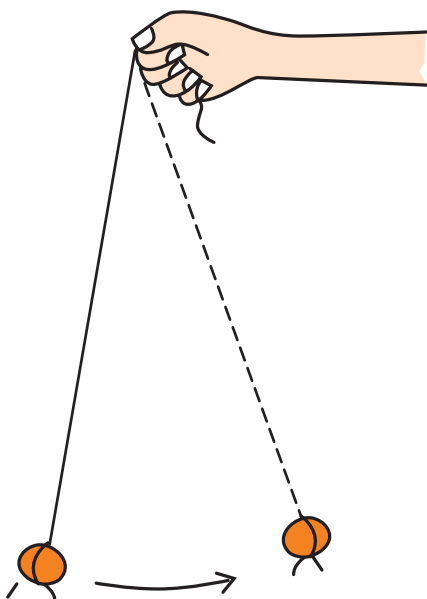
12. Make a Z shaped spring by first folding the frog backwards and then forwards.



13. Press the spring to make the frog jump and leap.



## SIMPLE PENDULUM



Hold a string with a stone tied to the end so that it can swing without touching anything. Give it a slight push so that it swings gently. Make the string longer and shorter and notice whether the stone swings quickly or slowly.

Take a 1 metre long string and hang it by a nail so that it swings freely. Give it a light push so that it starts swinging gently. You will find that the time the stone takes to go from one side to the other is one second when the string is one metre long. Count sixty swings to understand how long one minute is.

Practice counting swings with your eyes shut while your friend watches the swinging stone. In this way you can learn to count seconds even without a swinging stone.

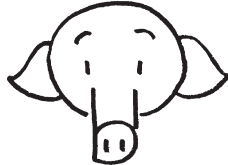
# A B C Pictures

Find the alphabets in the pictures. Make some on your own.

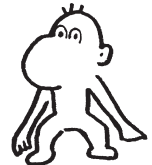
**A**



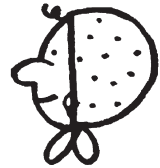
**B**



**C**



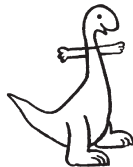
**D**



**E**



**F**



**G**



**H**



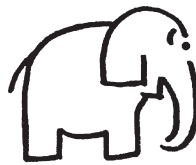
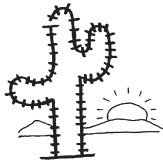
# A B C Pictures

Find the alphabets in the pictures. Make some on your own.

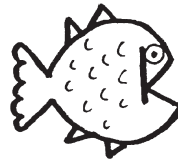
I



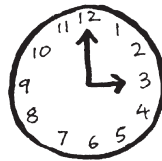
J



K



L



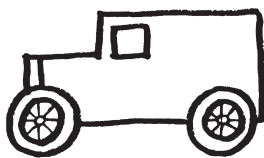
M



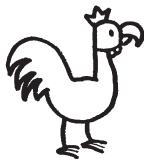
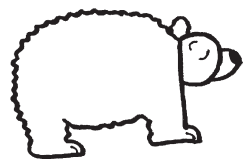
N



O

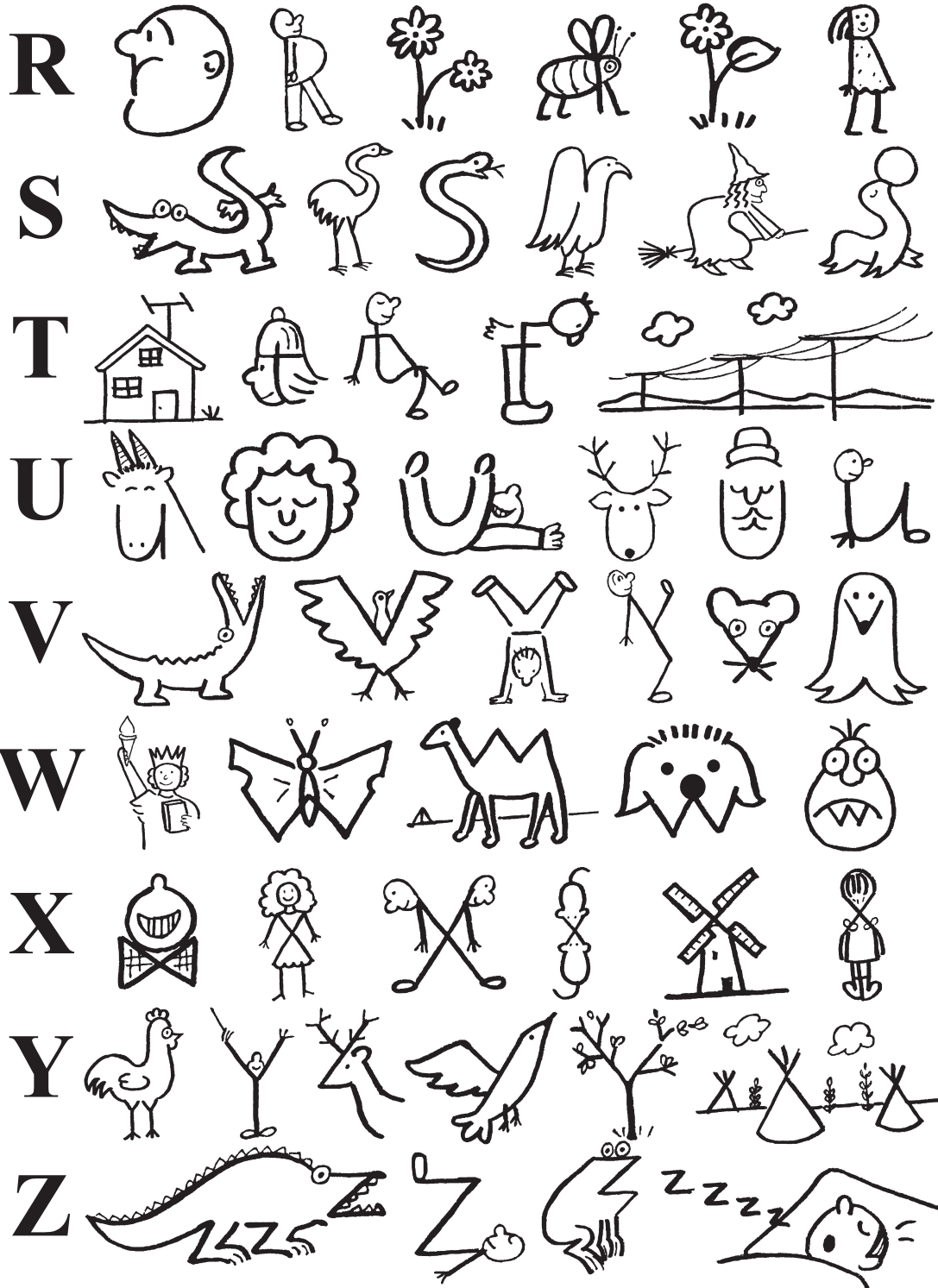


P



# A B C Pictures

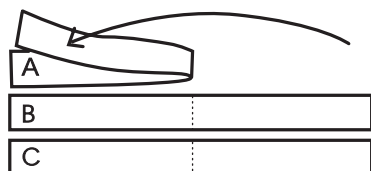
Find the alphabets in the pictures. Make some on your own.



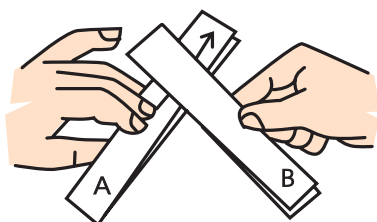


# THREE BLADE FAN

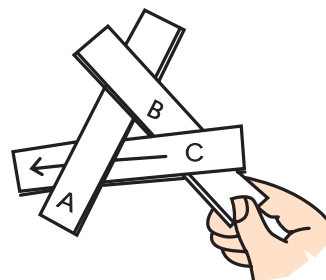
This is a two minute toy. It is a very simple toy to make and it is great fun to play with.



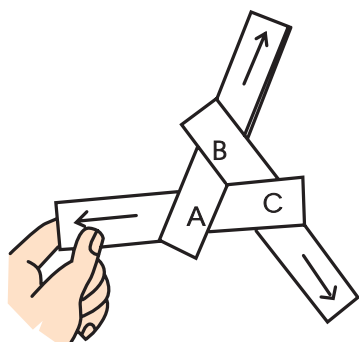
1. Cut three long strips from an old postcard each about 1.5 cm wide. Fold each strip A, B, C in half from the right to the left.



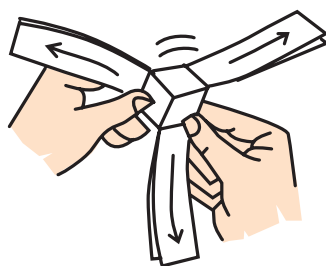
2. Take strips A and B and put A inside B like this.



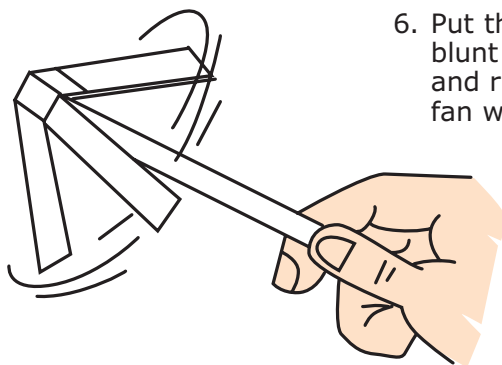
3. Weave strip C into place.



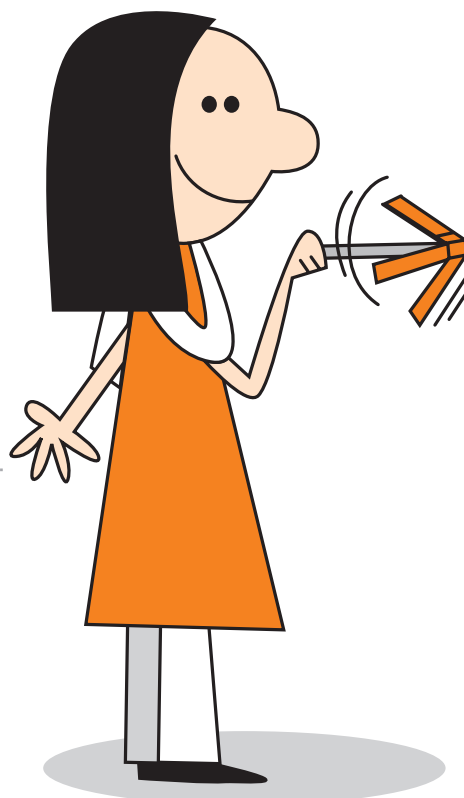
4. Pull the strips in the direction as shown ...



5. ...to make a tight paper knot. The interlocking of the three strips makes a bowl like form.

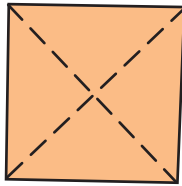


6. Put this fan on a blunt point of a pencil and run with it. The fan will rotate.

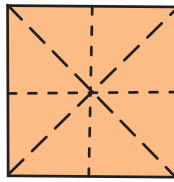


# FLAPPING BIRD

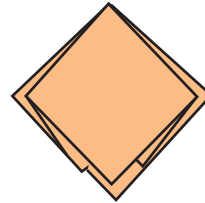
Children in Japan have been making this flapping bird for the last 300 years.  
You do not require a scissors or glue to make it. You just need a paper square and your fingers.



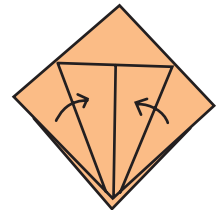
1. Start with a square. Fold a criss-cross. Then turn over. You will find a hillock.



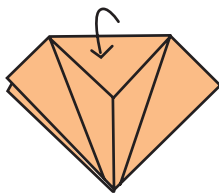
2. Fold a plus sign in the opposite direction.



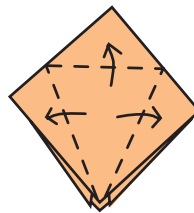
3. Fold to make a bud - a quarter square.



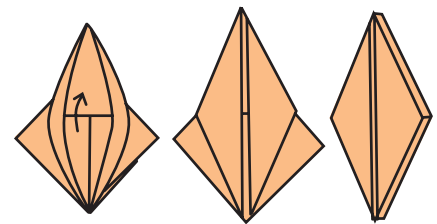
4. Fold left and right flaps to the vertical centre line.



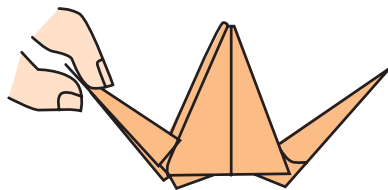
5. Fold the top triangle to make a cobra head.



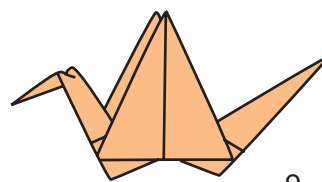
6. Lift one layer to the base of the top triangle to fold a diamond.



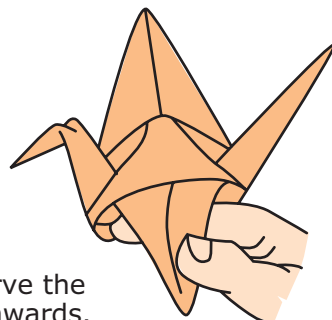
7. Similarly make another diamond on the reverse. This is the bird-base.



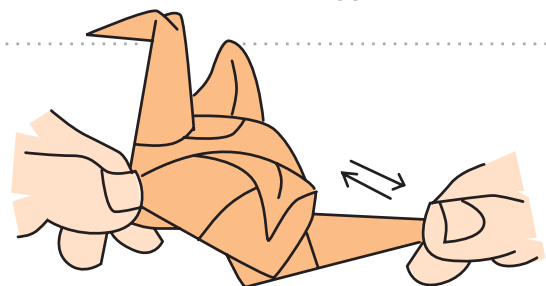
8. Lift the cut portions between the two wings.



9. Fold a beak on the neck.



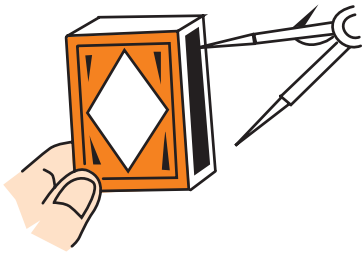
10. Gently curve the wings downwards.



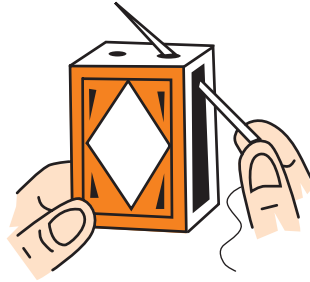
11. Hold the bottom of the bird's neck with one hand and pull its tail repeatedly with the other. Its wings will flap.

# MATCHBOX RIDER

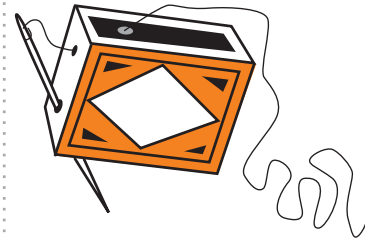
All it takes to make this matchbox train is an old cardboard matchbox and some thread. As you move your hand the toy matchbox moves on the thread rail track.



1. Make four holes on the matchbox- two on the drawer and two on the strike surfaces.



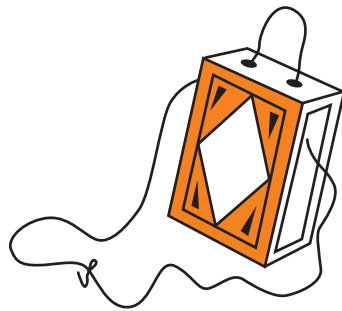
2. Take a needle with a 1.5 meter long string. Poke the needle from the strike surface hole into the drawer hole.



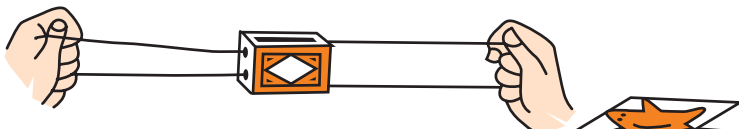
3. Thread the needle through the other holes too.



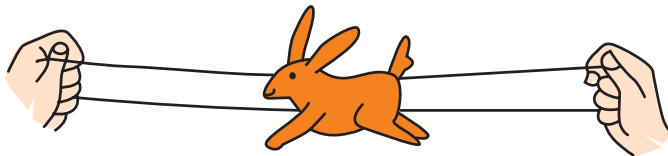
4. This is the threaded matchbox.



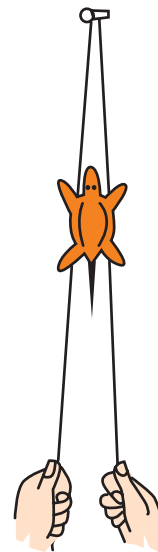
5. Now tie the two ends of the thread to complete the mechanism.



6. Hold the string in both hands. Turn and twist the left hand. The matchbox will travel on the string track towards your left hand.



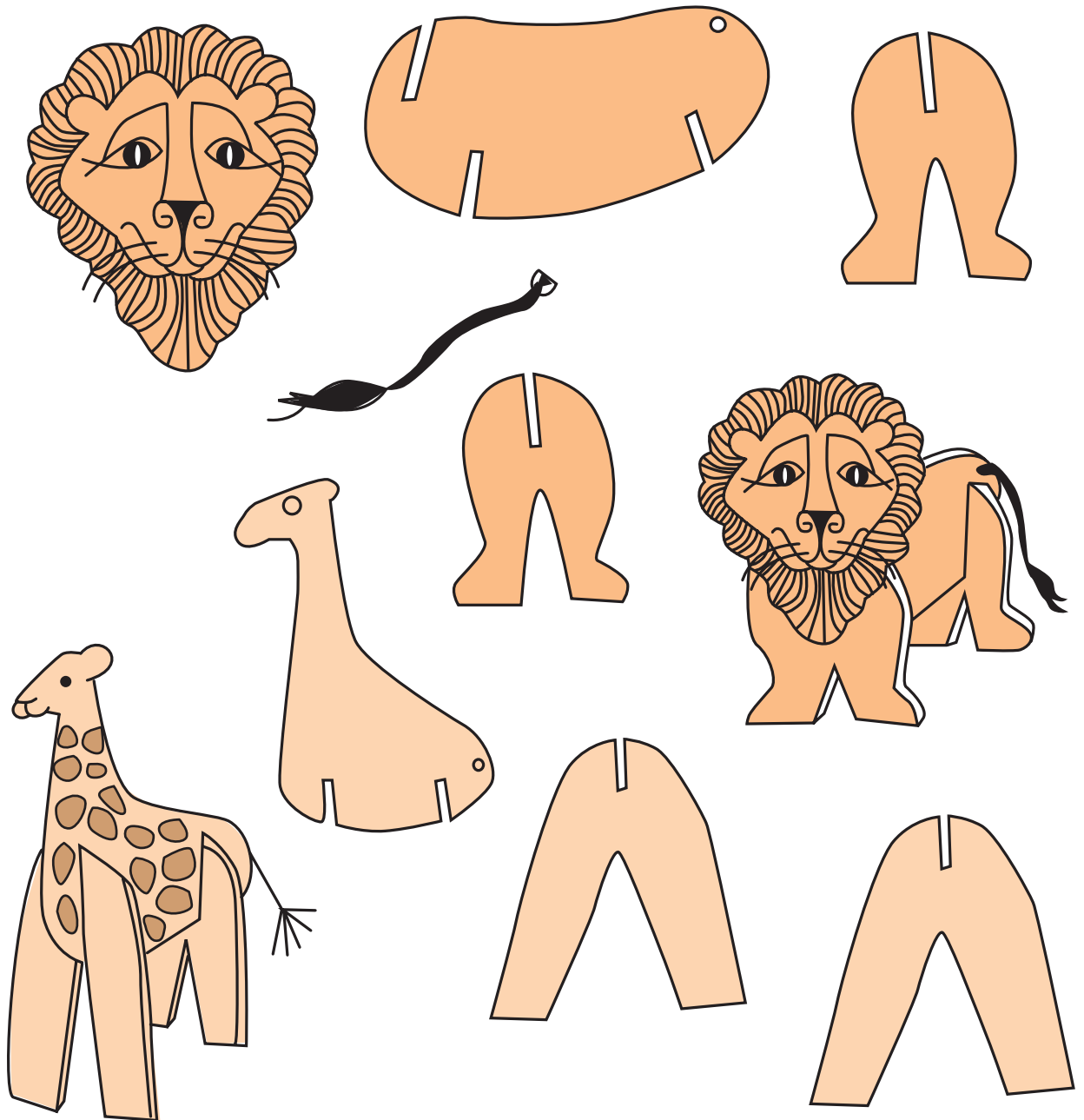
7. You can stick the picture of a rabbit on the matchbox and enjoy the rabbit hop at your fingertips. The mechanism moves only in one direction and you will have to bring it back once it reaches the left-hand end.



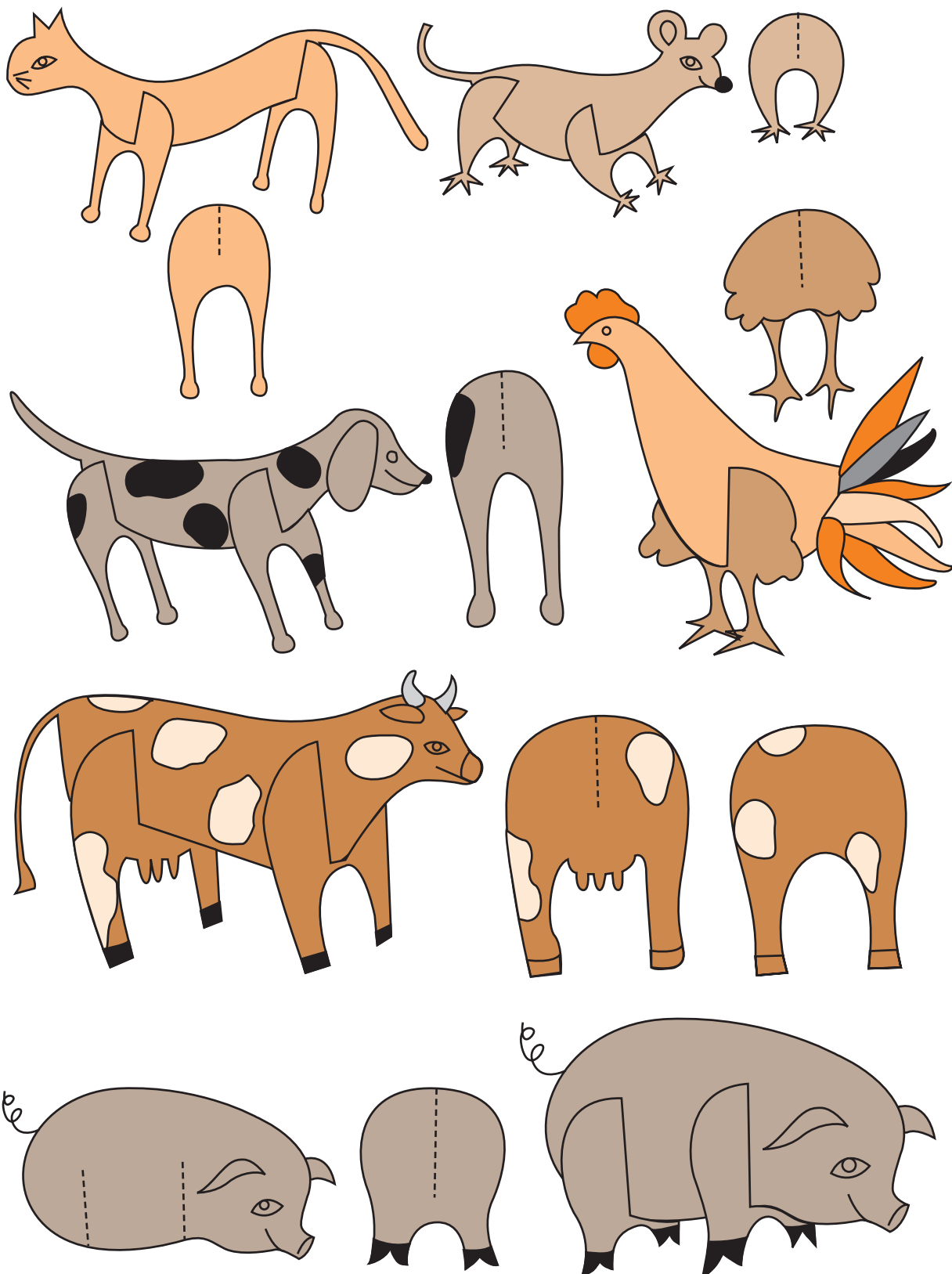
8. Hang the left string loop of the mechanism by a nail and stick a cut out of a lizard on it. On pulling the left and right strings alternately, the lizard will slowly climb up. This toy is based on friction.

# SLOTTED ANIMALS

**These slotted animals can be made out of the cardboard cover of exercise books. You do not require any glue or staples. These animals are collapsible and can be flattened when not in use. The body parts of the animals are interchangeable. Design a cat, A horse...**

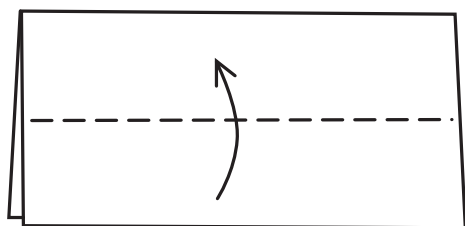


(From *Making Things* by Ann Sayre Wiseman)

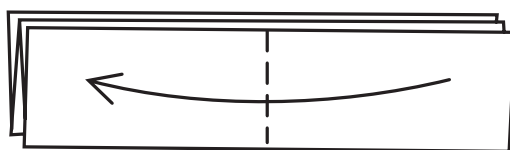


# PAPER PATTERNS

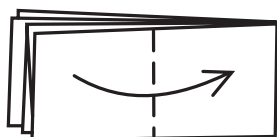
To make these cut-out repeat patterns all you will need are some paper squares (news papers will do) and a pair of scissors.  
First fold the paper in half.



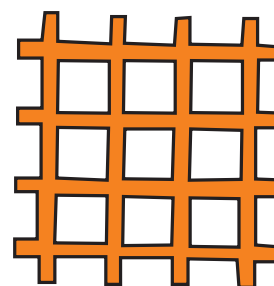
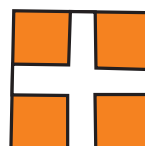
1. Fold the top layer of the bottom edge up to the folded edge. Turn over and do the same behind.



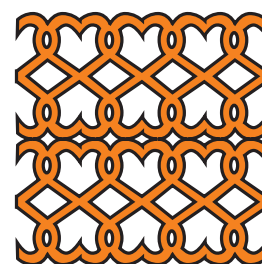
2. Fold the right edge to the left edge.



3. Fold the top layer of the left edge to the folded edge. Turn over and do the same behind. This gives you a little square of paper with sixteen layers. By cutting into this shape and unfolding you can discover many interesting patterns.



4. Simply cutting away each corner of the little square, for example will create a grill (Jaali) like pattern.

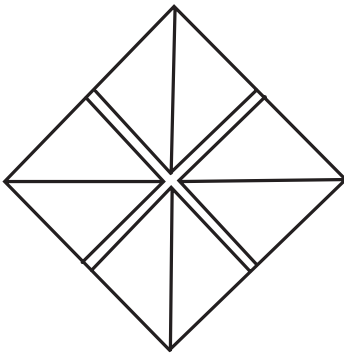


5. By cutting these two curves you will achieve a more complex pattern.

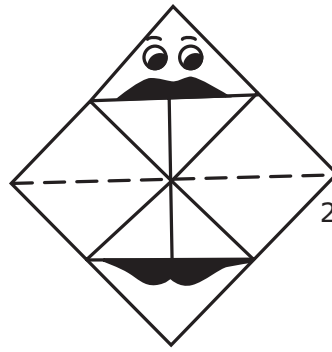
6. Experiment in this way and when you find a pattern which you like make several ones. You can stick them together to decorate the cover of a book or perhaps to decorate a wall. You can make lovely greeting cards by sticking the cut-out of one colour on a background card sheet of a different colour.

# CHATTER BOX

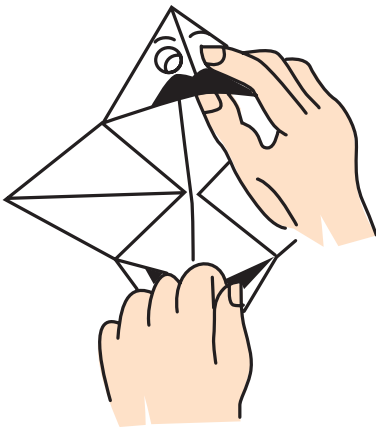
Let's make an interesting chatter box.



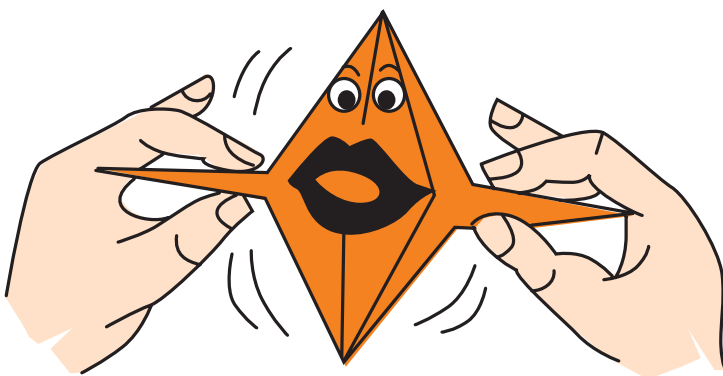
1. Fold all four corners of a square to meet at the centre. Turn this envelope and fold all 4 corners once again to the centre. Take this double envelope base and fold its two opposite flaps in the middle. These two triangles will make the upper and lower halves of the chatterbox's face.



2. Crease along the middle line and draw the face.



3. Slip your thumb under the upper half of the face and pinch the centre crease, so that the nose stands out. Pinch the bottom centre crease too.

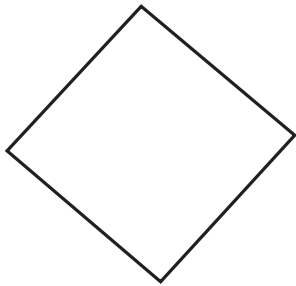


4. Hold the side corners with the thumb and index fingers of both your hands so that the two halves of the face are brought together. By moving your hands you will be able to make the chatterbox chatter.

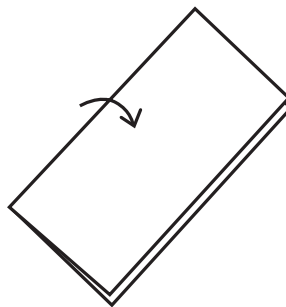


# FOLDING CALENDAR

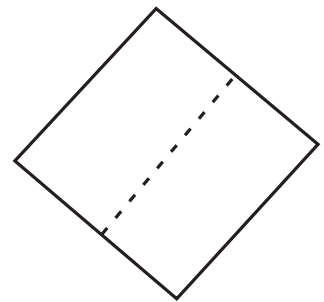
This wonderful calendar was designed by the Sita School located on the outskirts of Bangalore. Children paint, print and sell these calendars by the thousands to raise money for their school.



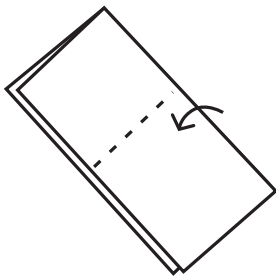
1. Take a square of paper 25 cm x 25 cm.



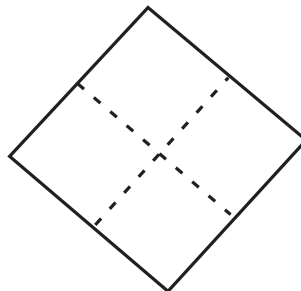
2. Fold it in half.



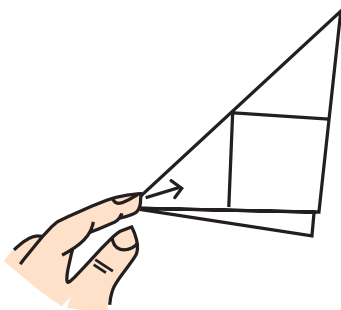
3. Open it.



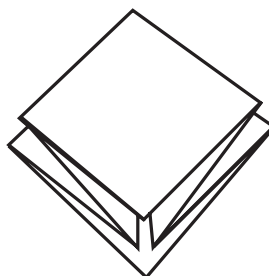
4. Again fold it in half.



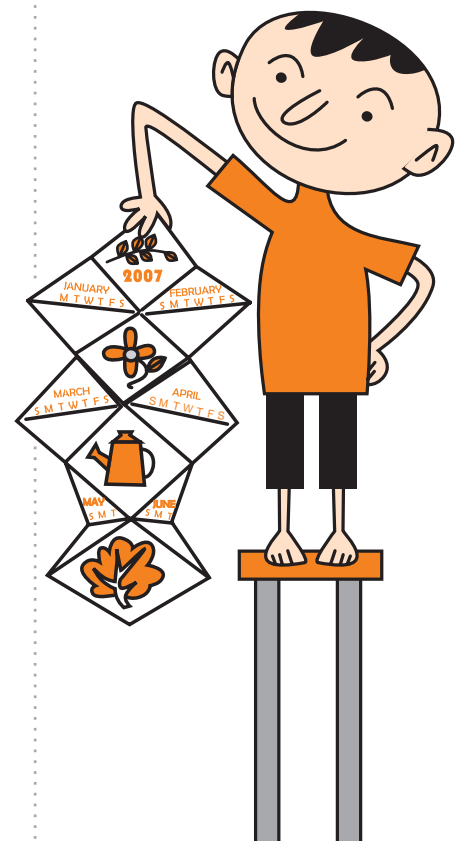
5. To make a plus sign.



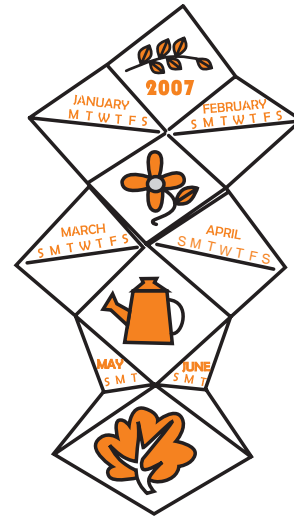
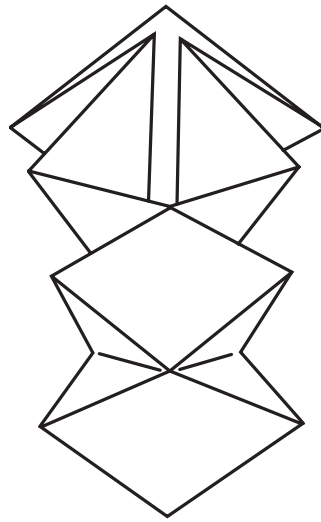
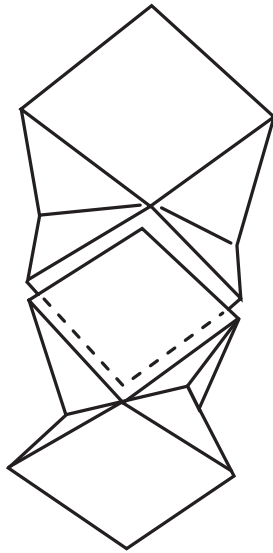
6. Now fold it along both diagonals and squash.



7. To make a small square springy shape. We need 3 such pieces.





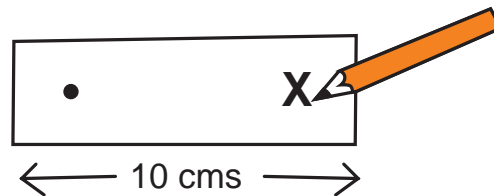


8. Take two such springy pieces. Glue one on top of the other.

9. Similarly, glue the third springy piece to the previous two. The assembly will open and close like an accordion.

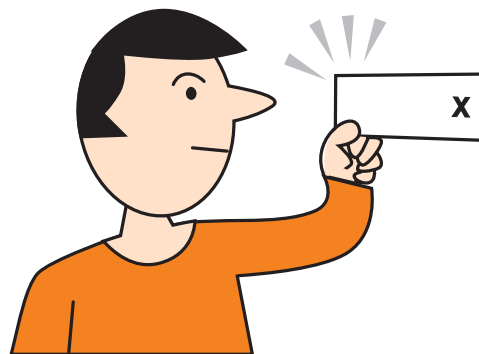
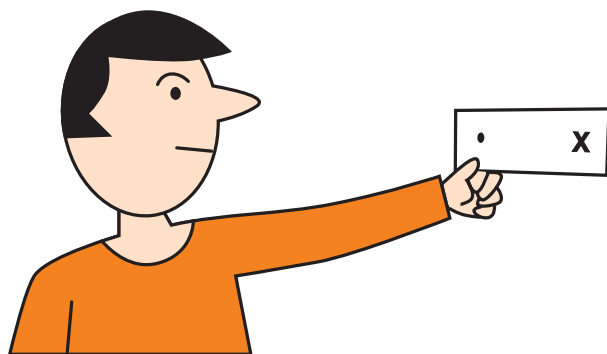
10. You could use this lovely foldable model to depict a picture story, calendar or whatever else you wish.

## DISAPPEARING DOT



1. You will need a piece of card sheet, a sketch pen and a ruler. Draw an **X** on the right side of the card.

2. Draw a dot 10 cm to the left of the **X**.

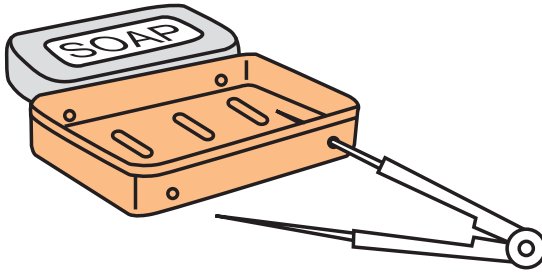


3. Hold the paper at arm's length in front of you and look hard at the **X**, you will now be able to see the dot out of the corner of your eye.

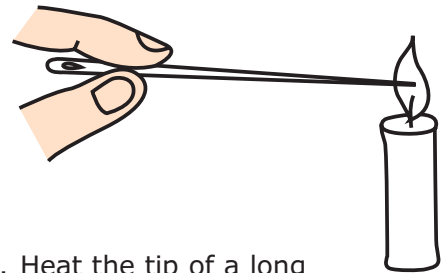
4. Keep concentrating on the **X** and slowly bring the paper closer to your eyes. Suddenly the dot will disappear completely from view.

# PULLBACK CAR

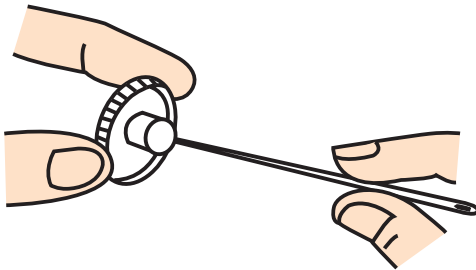
Mr. K.V.S. Kartha - an active member of the Kerala Sastra Sahitya Parishad (KSSP), devised this very delightful car. On being pulled back this car stores energy. On leaving it - this energy is released and the car dashes forwards.



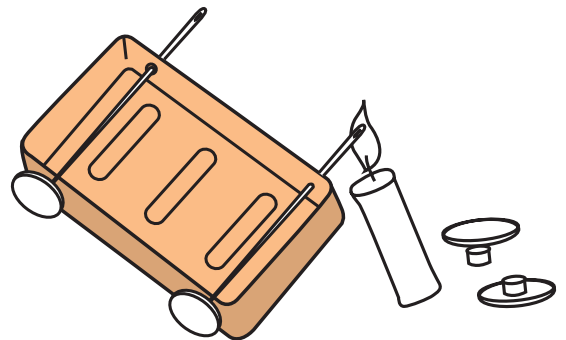
1. Take a small plastic soap case and make four holes in it with a divider point.



2. Heat the tip of a long needle.



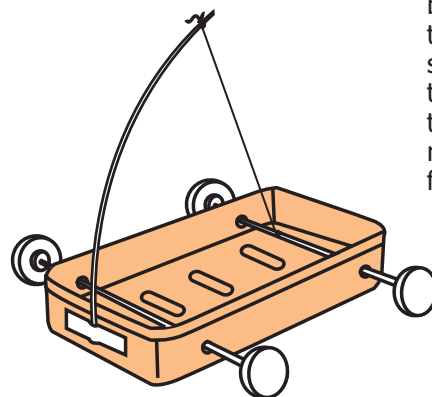
3. And poke it in the center of a cheap quality plastic button.



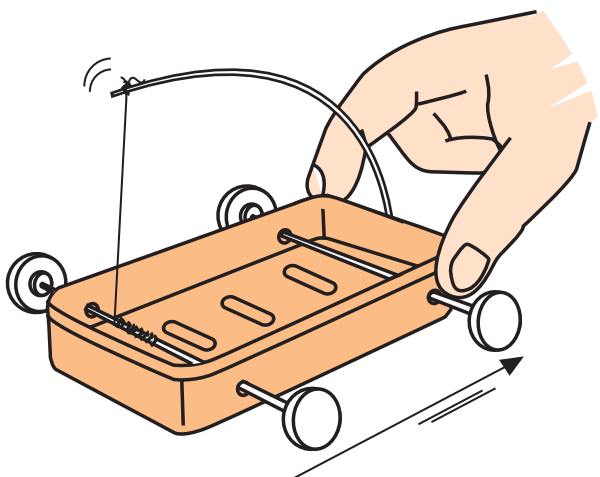
4. Put two such button and needle assemblies in the holes of the soap case. Heat the eye end of the needles to affix one button each.



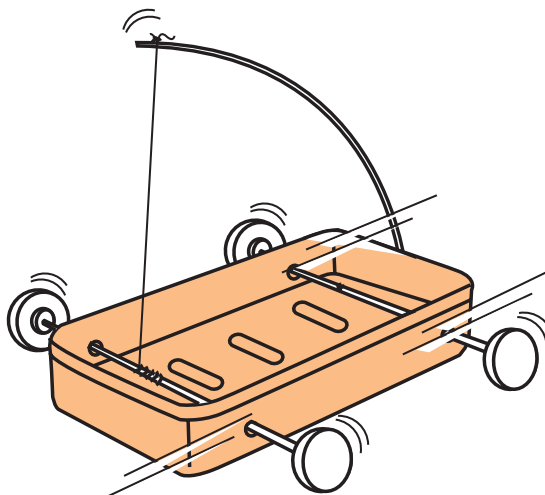
5. Now tie some sewing thread on the thin end of a 20 cm long broomstick.



6. Tape or tie the broomstick well to the side of the soap case. Tie the other end of the thread to the needle of the front wheels.

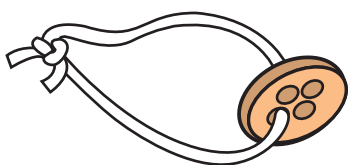


7. Now keep the car on the ground and pull it back. You can see the thread rolling up on the needle axle. This results in the broomstick bowing down and storing energy.

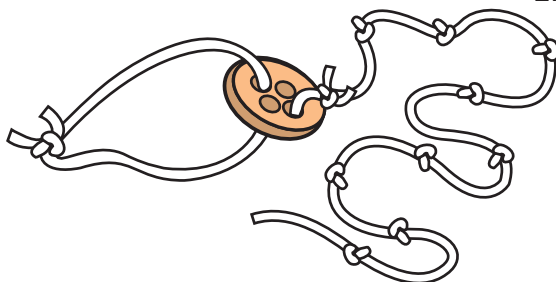


8. On releasing the car the stored energy in the broomstick propels the car forwards.

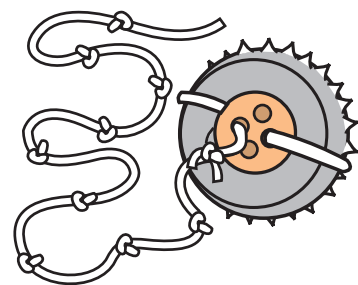
## TIK-TIKI



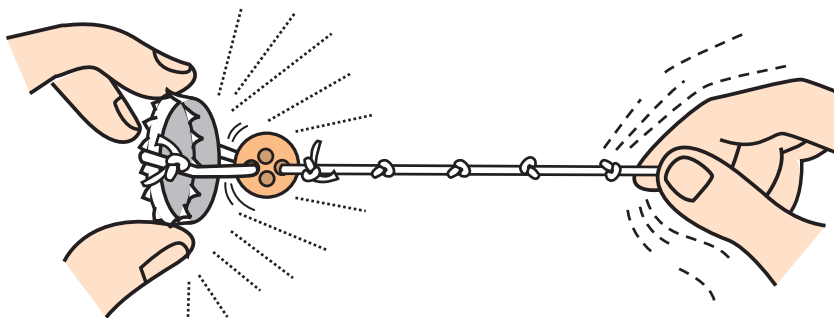
1. Cut a small rubber band and weave it through a shirt buttonhole. Tie a knot in the two ends of the rubber band.



2. Take a 50 cm long piece of thick string. Tie a series of knots along the whole length of the string. The distance between the knots should be 2 to 3 cm. Tie one end of the string to the button hole.



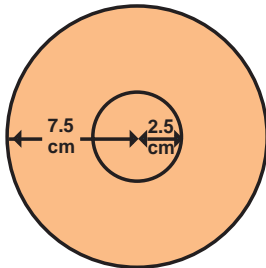
3. Stretch the rubber band and slide it on a soda water bottle cap.



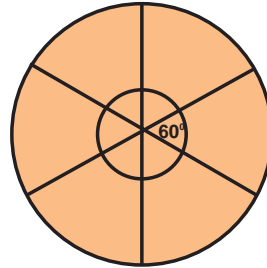
4. Hold the cap in your left hand. Gently press the string with your right thumb and index finger, and run them along the length of the string. At each knot the fingers slow down and the button hits the cap and makes a metallic tap. As the hand runs along the string there will be a series of tik-tikis.

# DANCING DOLL

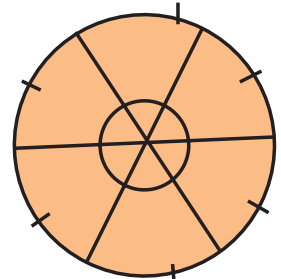
You will need one sheet of paper, pencil, ruler, scissors and craft knife, glue, compass and protractor.



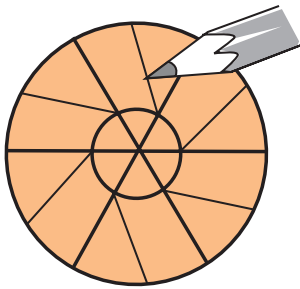
1. To make the skirt draw two concentric circles of 2.5 and 7.5 cm radius. Draw a horizontal line through the centre of the circles.



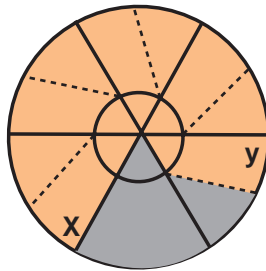
2. Draw 60 degree angles above and below the line from the centre. The circle will be now divided into six segments.



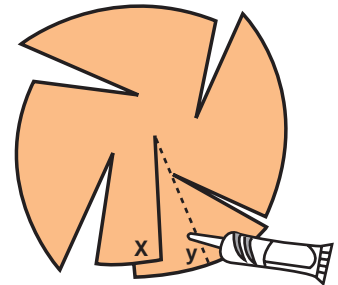
3. Mark the circumference of the outer circle at points half-way between each radial line.



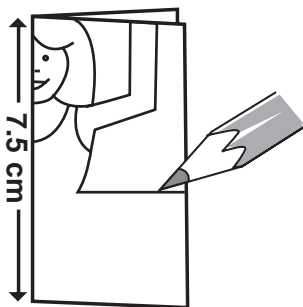
4. From these midpoints draw six slant lines as shown.



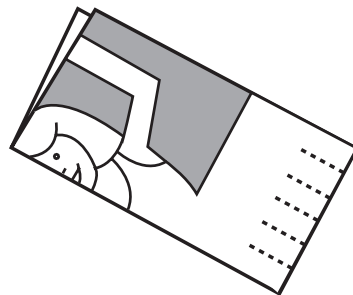
5. Cut along five of these lines. Make further cuts as shown and discard the shaded area.



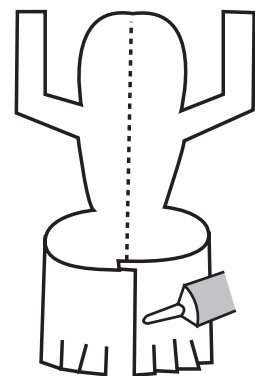
6. Form a cone by bringing points X and Y together. Glue them to complete the skirt.



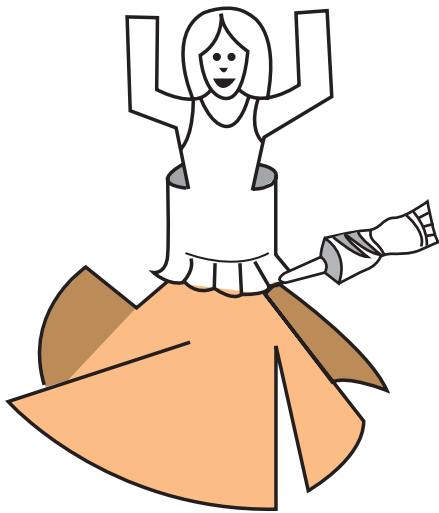
7. To make the doll: cut a 7.5 cm square of paper and fold it in half. Draw half the doll as shown.



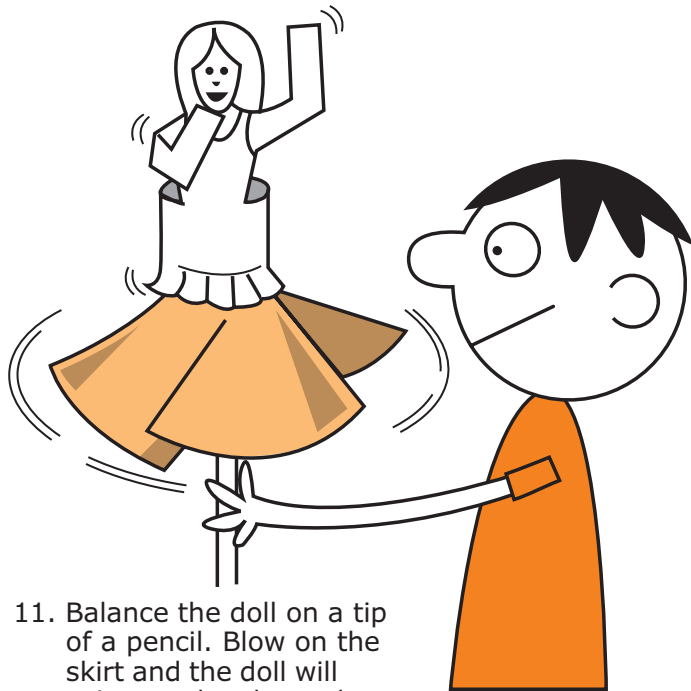
8. Cut through both the layers of the paper in one go. Discard the shaded area. Cut along the slit lines.



9. Unfold and shape the lower part. Overlap the two ends and glue them together.

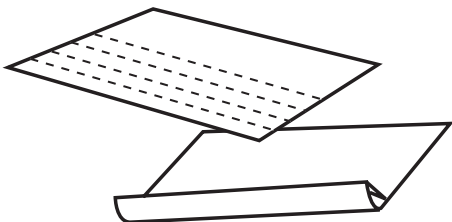


10. Raise the little tabs and glue them on the underside. Then fix the upper body to the skirt. Rearrange the arms.

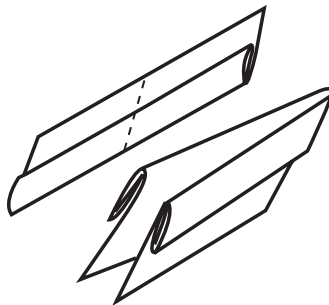


11. Balance the doll on a tip of a pencil. Blow on the skirt and the doll will spin round and round.

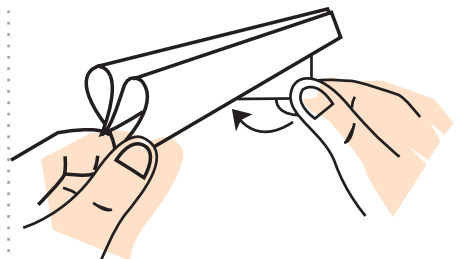
## PAPER CRACKER



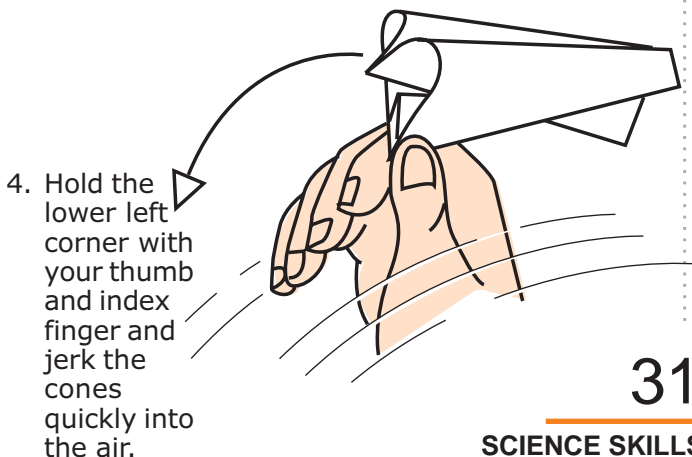
1. Take a 20 cm x 30 cm sheet of rectangular paper. Mark out six equal sectors along the width of the paper. Keep folding the sectors until just two remain.



2. Crease the model in half so that the folds are exposed.

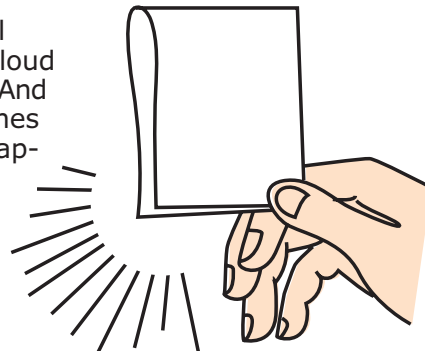


3. Push the bottom right hand corner inwards to form two cones



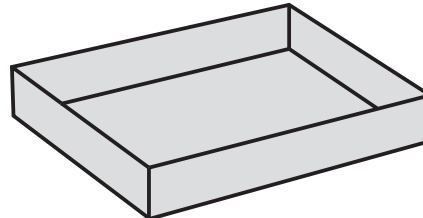
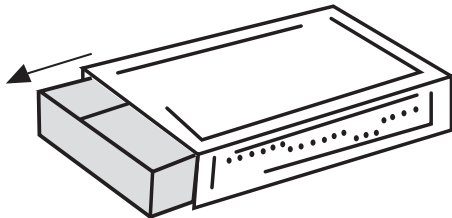
4. Hold the lower left corner with your thumb and index finger and jerk the cones quickly into the air.

5. You will hear a loud BANG! And the cones will disappear.

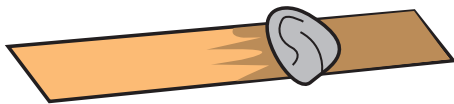


# SPRINGY CAT

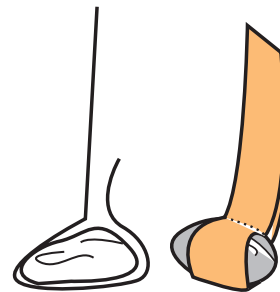
This is a fun toy. It is very simple too.  
As you fan the cat with a notebook it  
jumps on its springy feet.



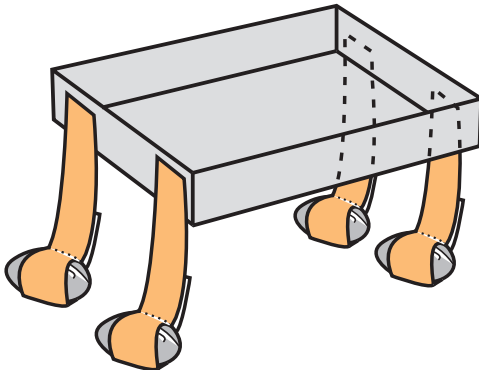
1. Remove the drawer from an empty match box. This will be the cat's body.



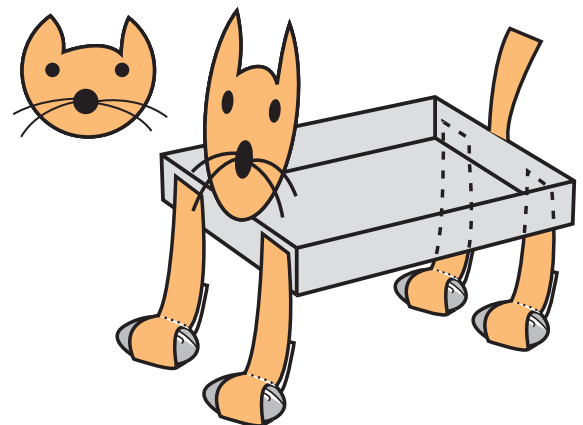
2. Take four strips of old Xerox paper 5 cm x 1 cm. Put glue on one end and wrap a light seed shell to make the cat's paw.



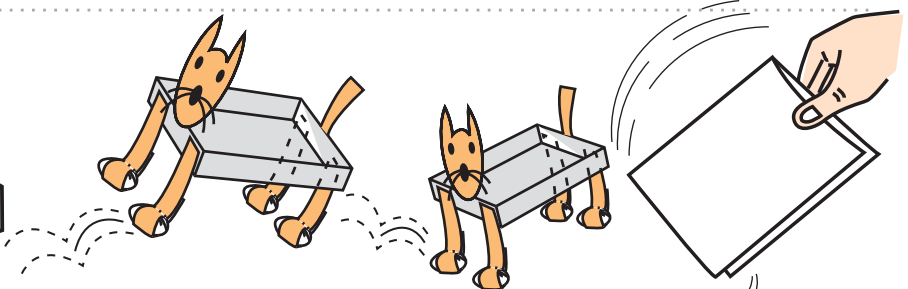
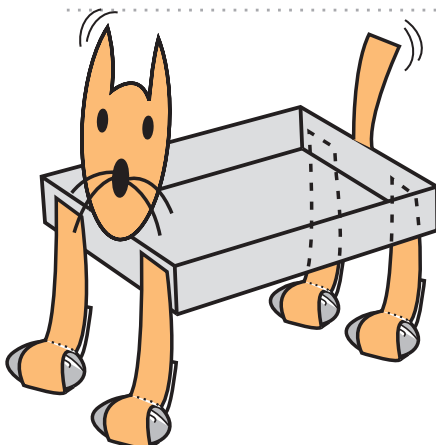
3. The details of making the paws are shown in this drawing.



4. Glue the four legs to the match box drawer.



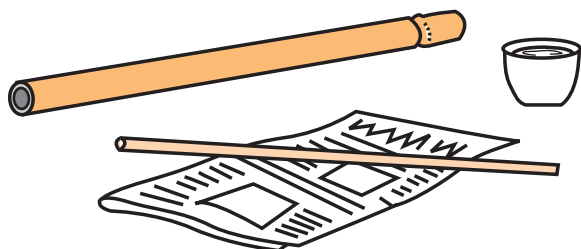
5. Fix a face and tail to make the cat look realistic.



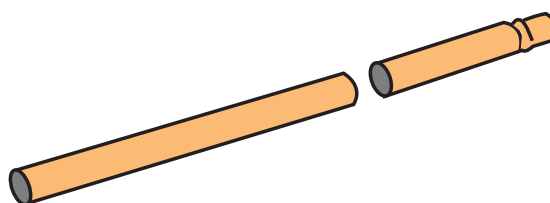
6. Place the cat on the ground and fan it with a notebook. The cat will jump on its springy feet.

# BAMBOO POPGUN

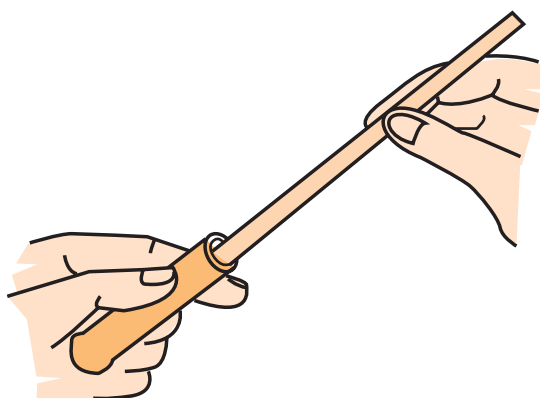
This is an illustrious example of an ingenious folk toy.



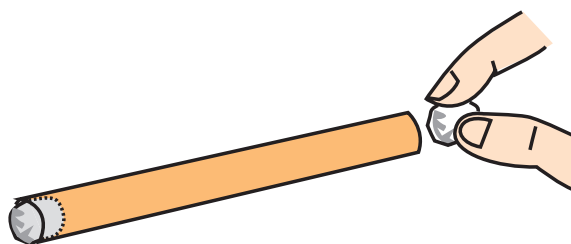
1. Take a 30 cm long piece of bamboo with an internal bore of 8-10 mm. The bamboo should be open at one end and closed at the other.



2. Cut the bamboo at a distance of 8 cm from its closed end.



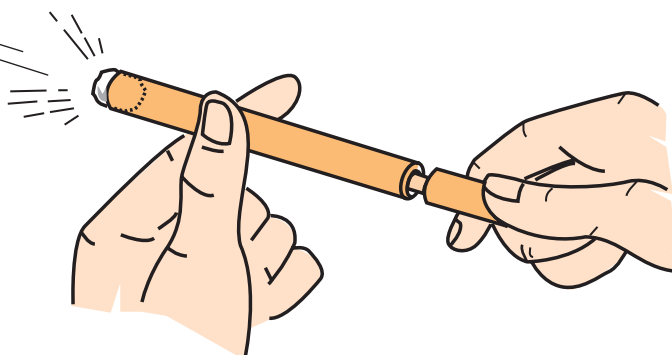
3. Place a 5 mm thick bamboo stick in the bore of the small piece. Hammer a few thin wedges to secure the bamboo stick in place. The bamboo stick attached to the handle now becomes the plunger.



4. How to make the pellets for the popgun? Dip a piece of newspaper in water. Tear out a piece of this soggy newspaper and make a little pellet out of it. Push this pellet into the bamboo bore with the plunger, until it just reaches the other end of the bamboo. Remove the plunger and place a second newspaper pellet as shown in Fig 4.



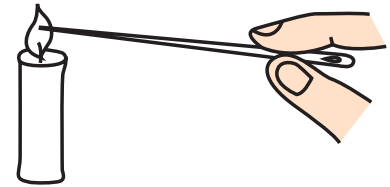
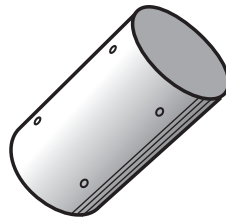
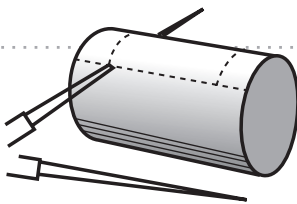
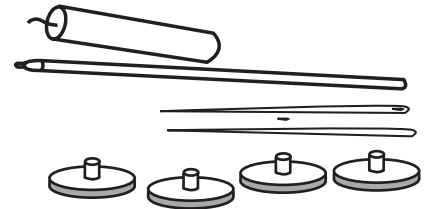
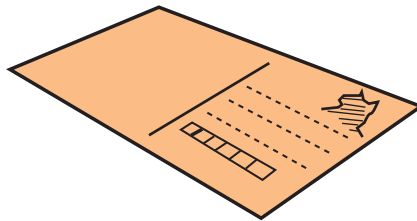
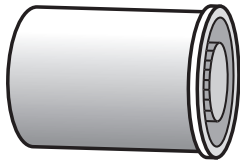
5. Using the plunger push this pellet in with force. You will be surprised to see the first pellet come out with a loud bang. When you push the second pellet, the air column between the two pellets gets compressed and pushes the first pellet to come out with a bang. As this happens, the second pellet occupies the position of the first one.





# SAIL CAR

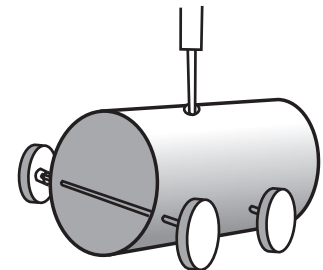
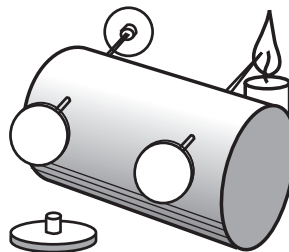
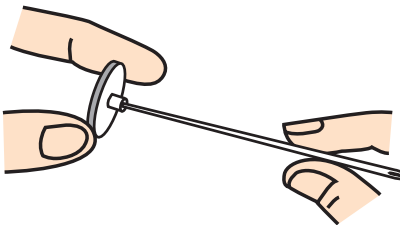
The awesome power of wind is being increasingly used in our country to produce electricity. This little sail car also demonstrates the power of the wind. The breeze from the ceiling fan is enough to make the car run.



1. First, mark out a rectangle 3.5 cm x 2 cm on a film-roll case. Then make four holes with a divider point.

2. The four holes for the two axles are shown.

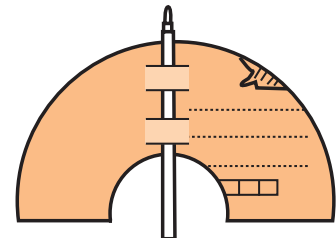
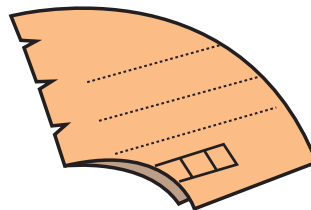
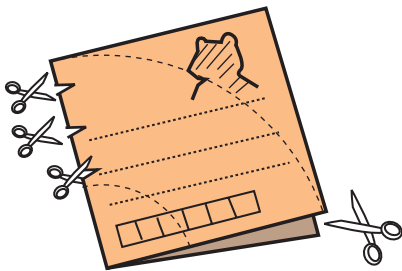
3. For making the wheels you need four buttons made of cheap plastic. These buttons have a protruding plastic pip in the middle. Take a 5 cm long needle and heat its tip.



4. Insert the needle tip in the center pip of the button. The hot needle melts the plastic and goes in.

5. Fit these one-wheel axles into the holes of the film-roll case. Now heat the other tip of the needle and fix the second wheel.

6. Make a vertical hole through the center of the car. The hole should be big enough to accommodate a ballpen refill into it.

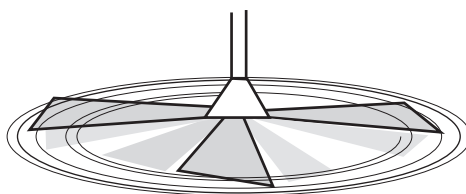
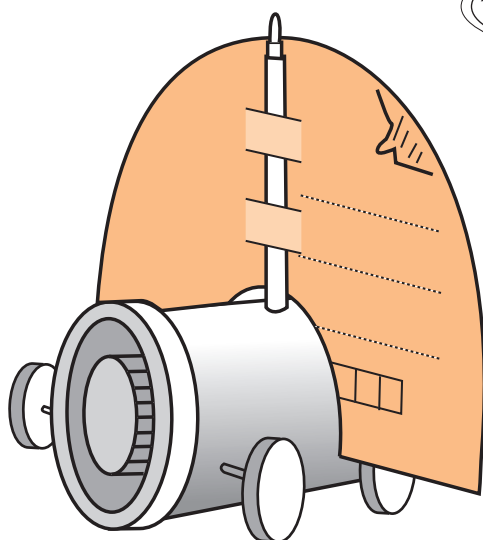


7. Double-fold a postcard and mark the two area and slits as shown.

8. Cut the two arcs and the slits.

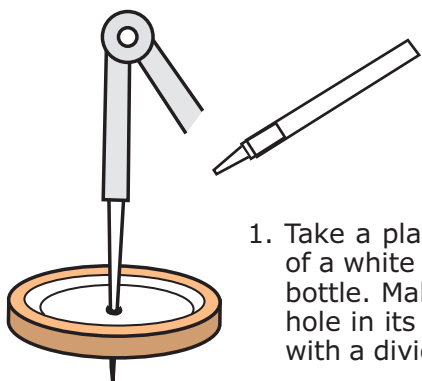
9. Now weave the ball-pen refill through the slits in the postcard. Fix the refill along with the postcard sail in the car



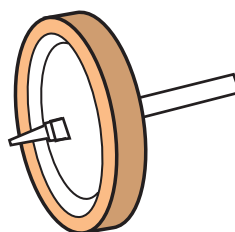


10. Replace the cap of the case. You can tie a thin string to the car and keep it on the smooth floor under the ceiling fan. The breeze will propel the car.

## CAP TOP



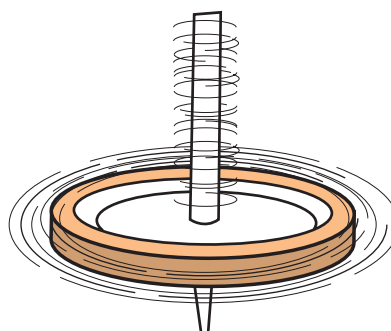
1. Take a plastic cap of a white film reel bottle. Make a hole in its centre with a divider.



2. Tightly fit the metal part of a 5 cm long refill in this hole (refills with long brass tips are best).



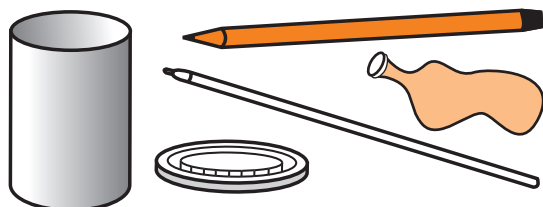
3. Now hold the plastic refill and spin this almost perfect top.



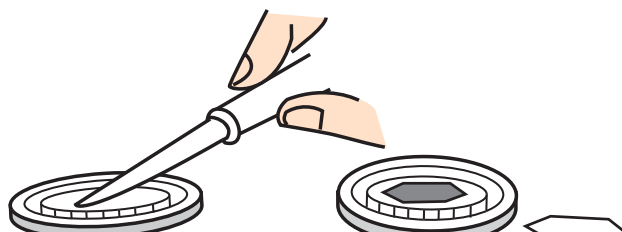
4. This toy has got all the attributes of a great top - a low centre of gravity and a large moment of inertia.

# MUSICAL BALLOON

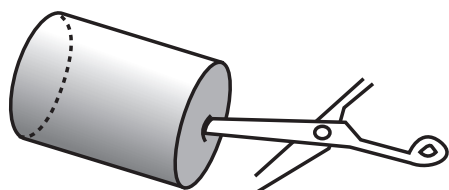
This musical instrument, which produces melodious notes, reminds one of the snake charmer's musical instrument – the *Been*.



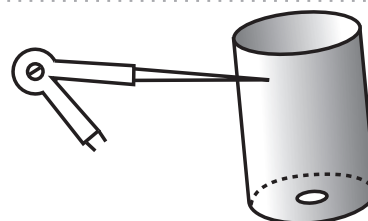
1. For making it you will need a film-roll case, a sketch pen, an empty ball-pen refill, a torn balloon and some ordinary hand- tools.



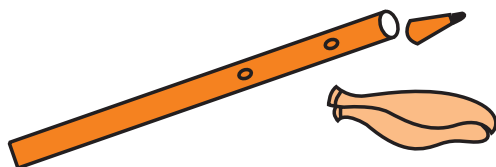
2. Cut the middle portion of the cap of the filmroll case with a sharp knife. The hole should be about 1.5 cm in diameter. Its shape is not important.



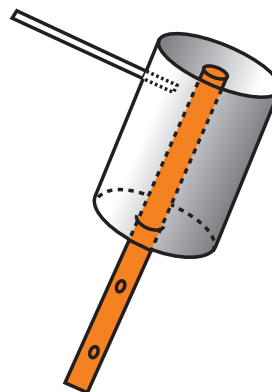
3. Make a hole in the middle of the base of the case. Use pointed scissors to widen this hole. The hole should be just large enough to squeeze a sketch pen through it.



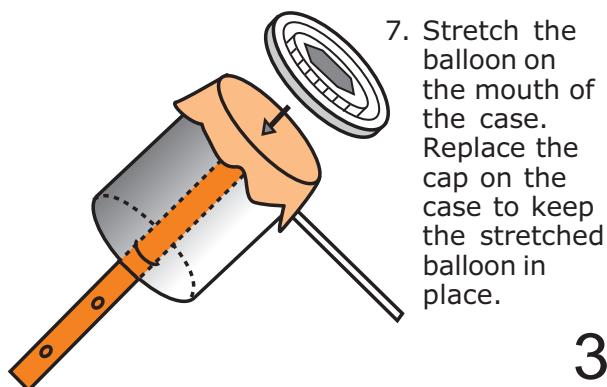
4. Make a small hole on the cylindrical surface of the case about 1 cm from the open end by using a divider point. This hole should be just big enough to enable a ball-pen refill to fit into it.



5. Take the sketch pen and snip off its pointed end. Make two small holes at a distance of 1 cm and 3 cm from this end. Cut a balloon as shown.



6. Press fit the sketch pen and ball-pen refill in the film-roll case.

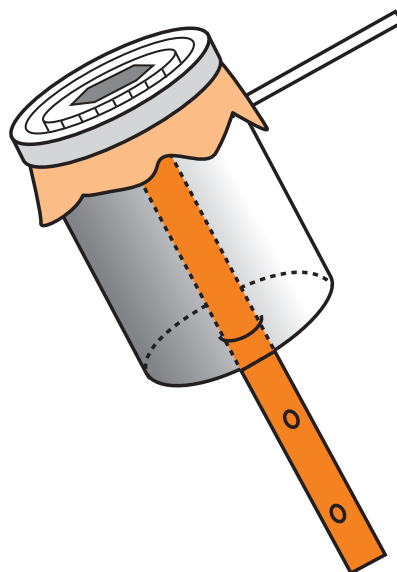


7. Stretch the balloon on the mouth of the case. Replace the cap on the case to keep the stretched balloon in place.



8. The complete assembly of the musical instrument is shown here.

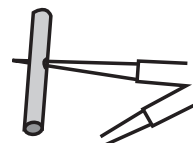
9. Now gently slide the sketch pen upwards so that it just touches the stretched balloon. Simultaneously, blow through the refill. At one particular position of the sketch pen, you will hear a clear and loud musical note. Fix the sketch pen in this position and keep blowing. By opening and closing the holes, as in the case of a flute, you can play a few notes. The balloon acts like a stretched membrane or diaphragm and begins to vibrate when you blow in. The plastic case acts like a sound box.



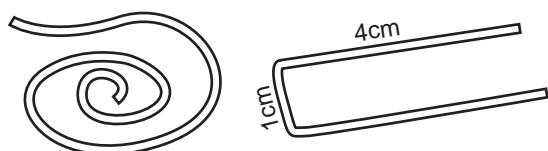
## SIMPLE SPINNER



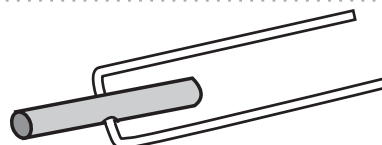
1. Cut a 2 cm long piece from an old ball-pen refill.



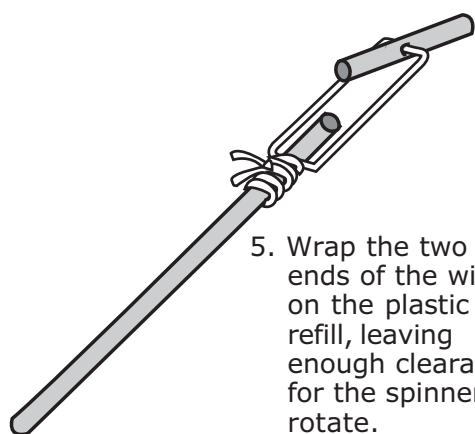
2. And make a hole in its center with a divider point.



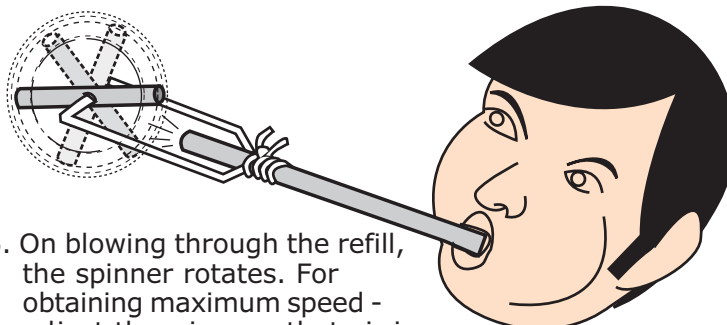
3. Take a thin wire of length 9 cm and fold it into U shaped wire



4. Weave the refill spinner in the U-shaped wire.

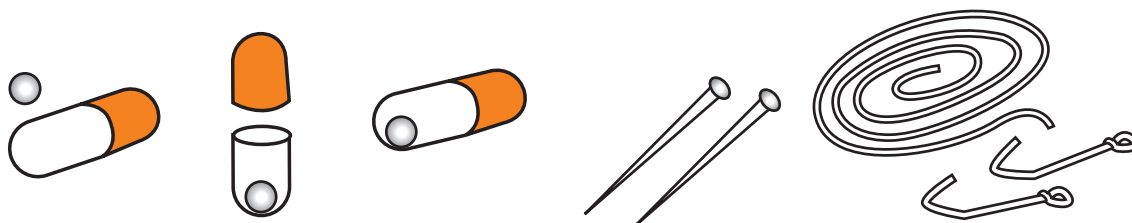


5. Wrap the two ends of the wire on the plastic refill, leaving enough clearance for the spinner to rotate.

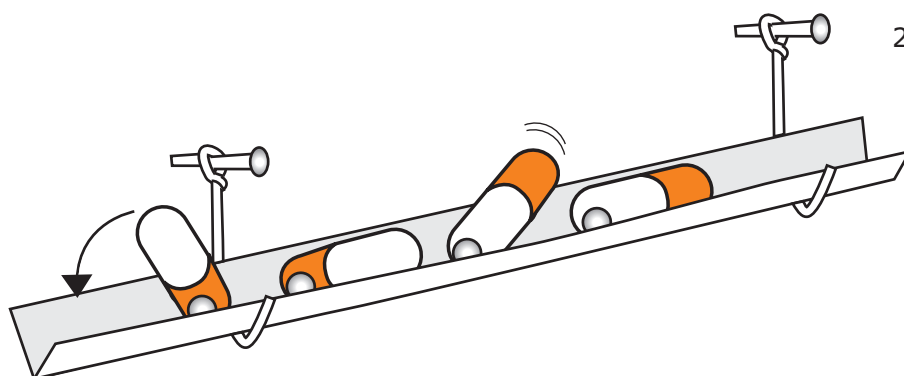


6. On blowing through the refill, the spinner rotates. For obtaining maximum speed - adjust the wires so that air is directed towards the ends of the spinner.

# TUMBLING CAPSULE

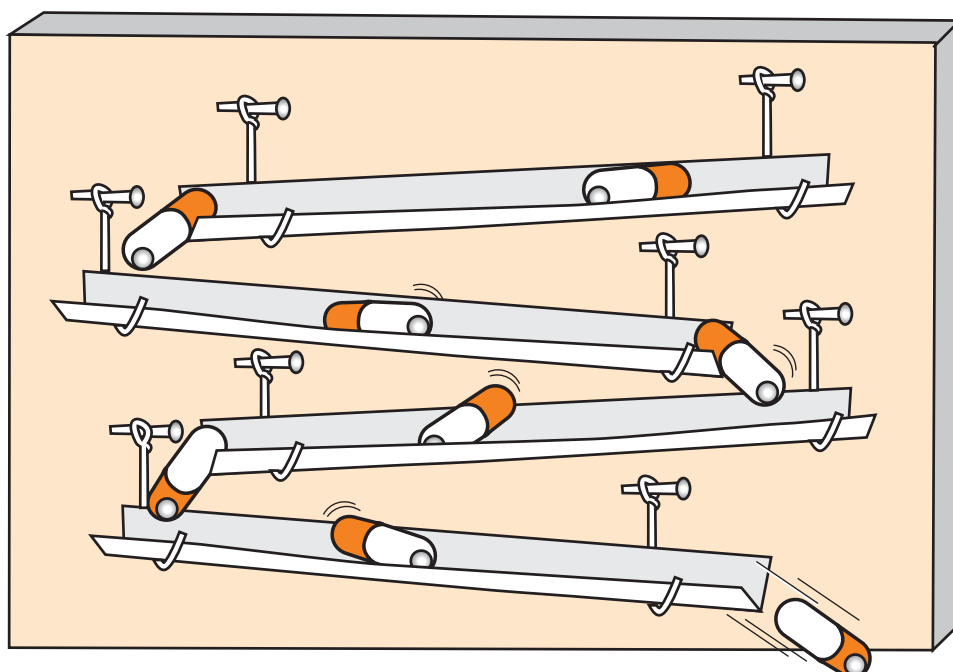


1. Empty medicine capsules can be used, or else take an old capsule, slide open its two halves and empty out its contents. Place a cycle steel ball in one half of the capsule and then close its lid.



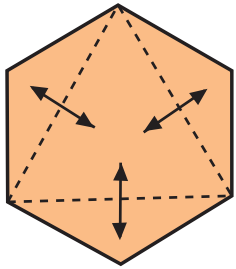
2. Fold a long card strip in the middle to form a V shaped channel. Place the capsule in the channel. On tilting the channel, the capsule somersaults and rolls from the higher to the lower level.

3. Use wire hooks to affix several V shaped channels on a vertical soft board. The slopes of the channel should be just enough to make the capsule roll. On placing the capsule on the high end of the top channel, it rolls down into the second, then the third and finally down the fourth.

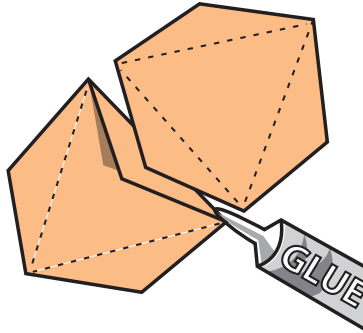


# PAPER BALL

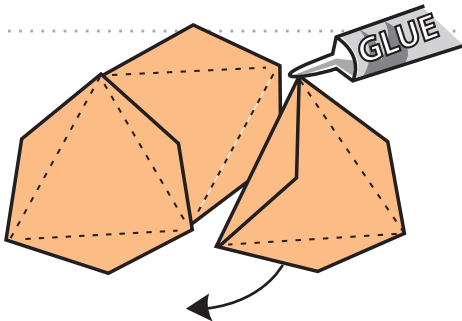
You will need 20 hexagons and glue, to make this Paper Ball.



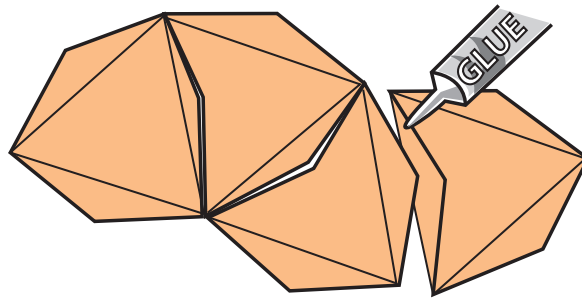
1. Take one hexagon and fold every other one of its corners to the centre. Make firm creases, then let the little triangular flaps so formed stand at right angles to the main area. Do the same with four more pieces.



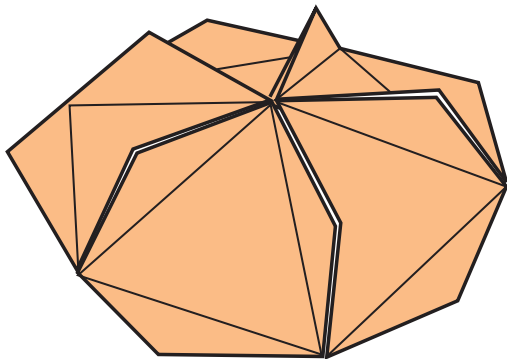
2. Join two pieces by gluing the outer sides of two flaps together.



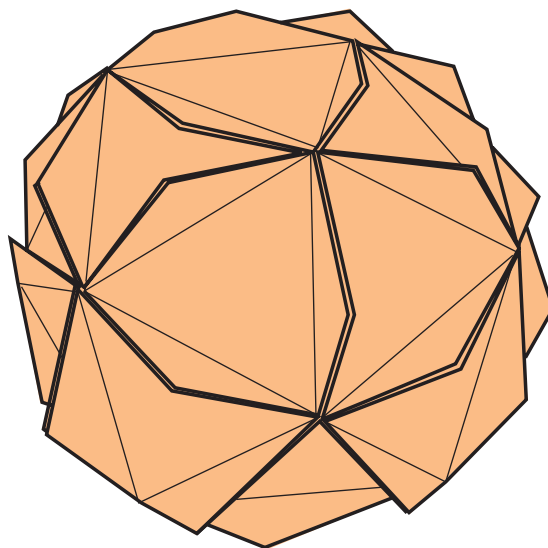
3. Similarly glue a third piece to the first two. Add two more pieces (following direction of the arrow in the diagram) with the fifth piece glued also to the first piece...



4. ... to complete a standing structure which has five triangular sides with little flaps in between.



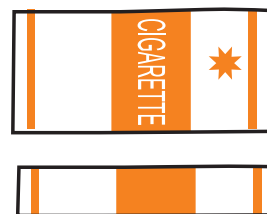
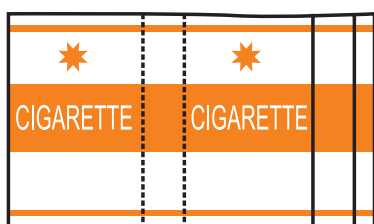
5. Now make a chain by gluing the remaining ten hexagons together in line. Note that the first three pieces are joined as shown in step 3 but the fourth piece is differently placed. Glue the two ends of the chain together. Then glue the top and bottom sections in place.



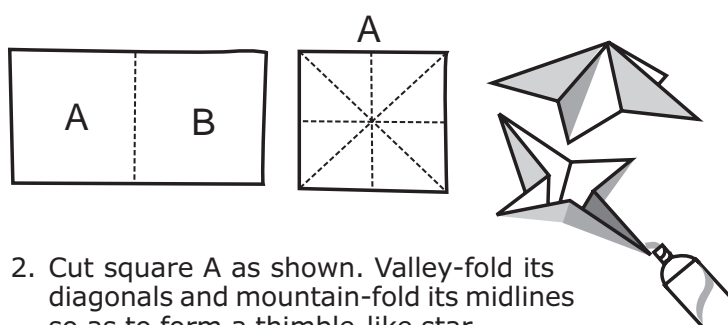
6. The completed twenty-piece ball.

# MERRY GO-ROUND

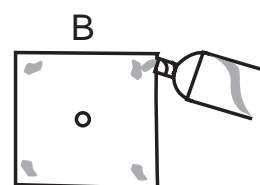
Sanjay Kapur, a student of class eleven, designed this lovely toy. To make this all you need is the outer case of a cigarette packet, a toothpick, an old refill, an eraser, glue and scissors.



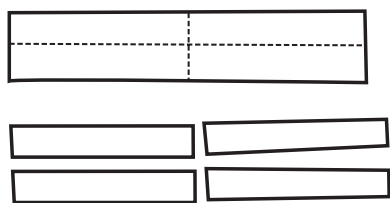
1. Open out a cigarette packet case and cut along the two dotted lines. The round-about has a starshaped thimble at the top and a square at the base. These are joined together by four pillars. The big piece form the top star and the square base. The four pillars will come from the small piece.



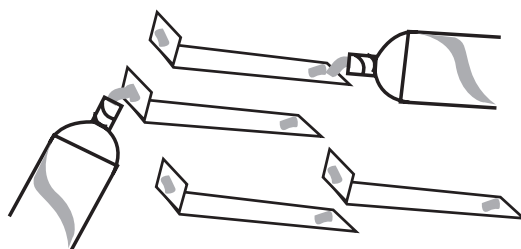
2. Cut square A as shown. Valley-fold its diagonals and mountain-fold its midlines so as to form a thimble-like star.



3. Cut a smaller square B from the remaining portion. Apply glue on its four-corners and make a small hole in its middle.

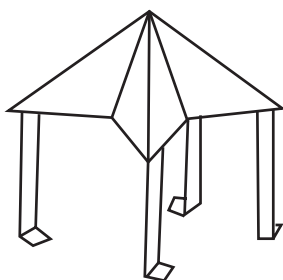


4. Mark out the midlines of the small rectangular piece and cut along them, to get four small rectangles.

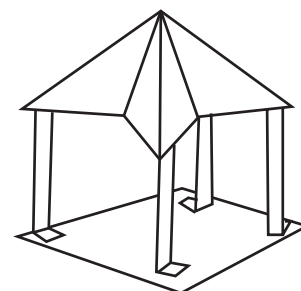


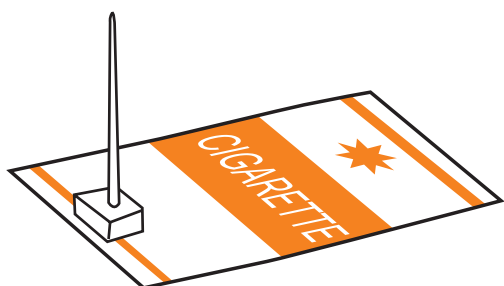
5. Fold a 3-mm upright leg in these rectangles and apply glue.

6. Stick with glue the straight ends of these rectangular pillars to the star-shaped thimble, such that the upright legs are in the same orientation.

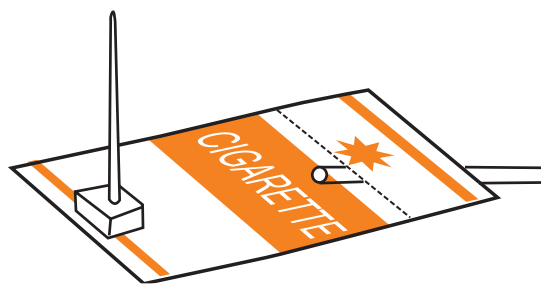


7. Glue the legs to the corner of the square base to complete the rotating part.

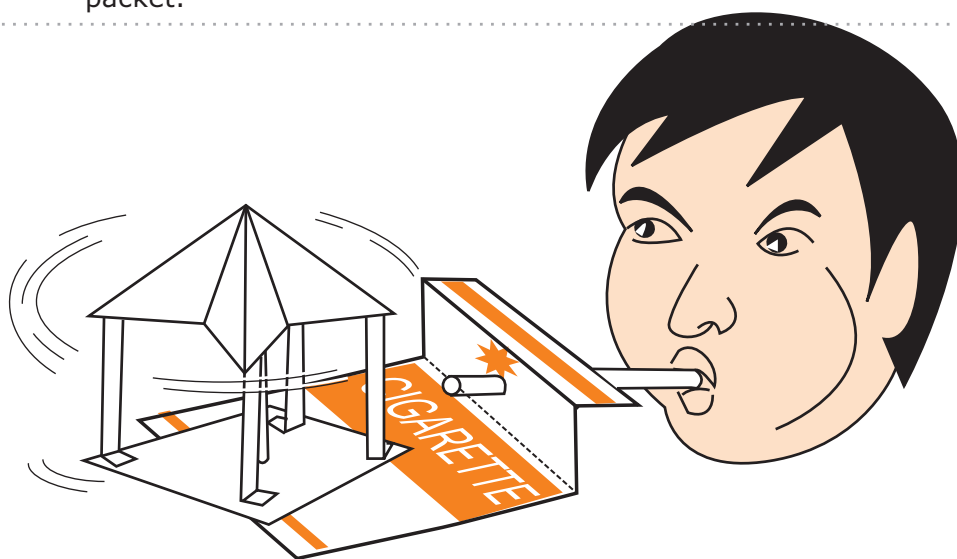




8. Poke an eraser with a divider point and fix a toothpick in it. Stick the eraser at one end of the cigarette packet.

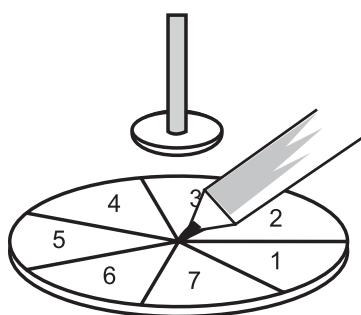


9. Fold this pack along the dotted lines and stick an empty refill for blowing.

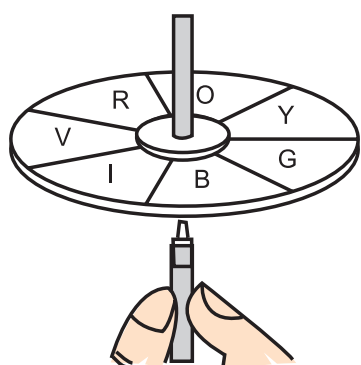


10. Place the roundabout on the toothpick and blow through the refill. The air will strike the vertical pillars and make the merry-go-round whirl.

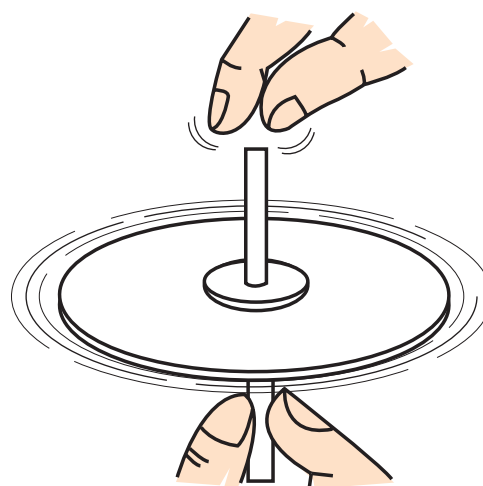
## NEWTON'S DISC



1. Cut a circular disc of diameter 6-cm from a tetra pack. Insert an empty ball-pen refill in a rubber washer.



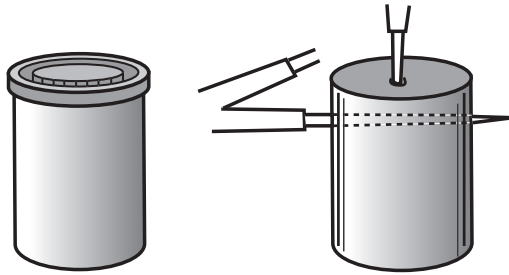
2. Fix the rubber washer in the center of the disc. Stick a piece of paper with the seven colors of the spectrum - VIBGYOR, painted on this disc. Pivot the disc on the brass tip of an ordinary ball-pen refill.



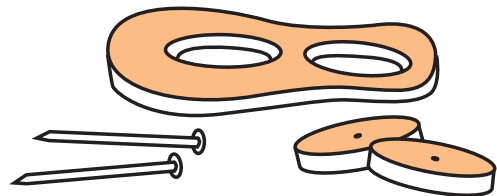
3. Spin the disc with the top of the refill and see all the seven colors combine to look grayish-white. The plastic refill, on its own brass tip, makes for a very smooth bearing.

# DANCING DOLL

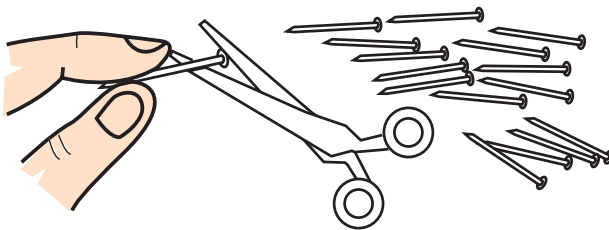
When you turn the handle of this toy, the dancing doll goes round and round.



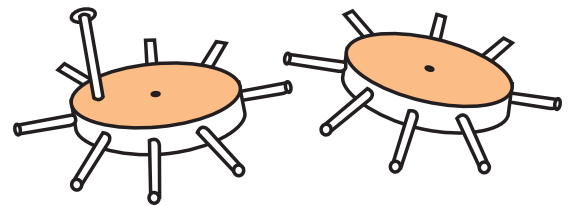
1. Take a film-roll case and make a hole in its base. This hole should be just big enough to press fit a plastic refill. Also make a horizontal hole in the case, 1.5 cm from the base.



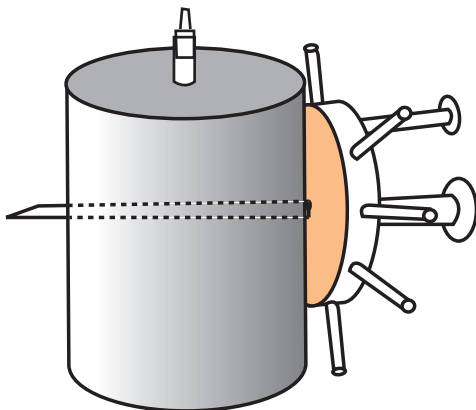
2. Cut two circular or octagonal discs, 3 cm in diameter, from an old slipper. Make holes in the centers of these discs.



3. Snip off the heads of 16 steel pins with scissors.



4. Fix eight pins equidistantly on the rim of each disc. Fix a nail for the handle near the edge of one disc.

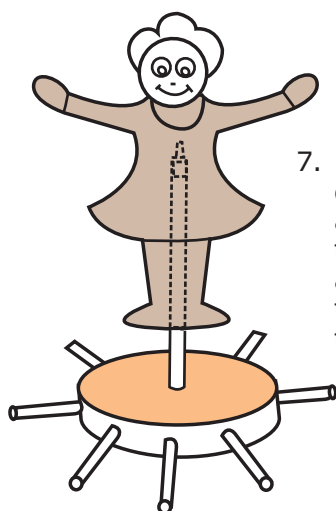


5. Attach a ball-pen refill to the base of the case. Pass a nail through the center of the disc with the handle. Pass this nail through the holes in the case.

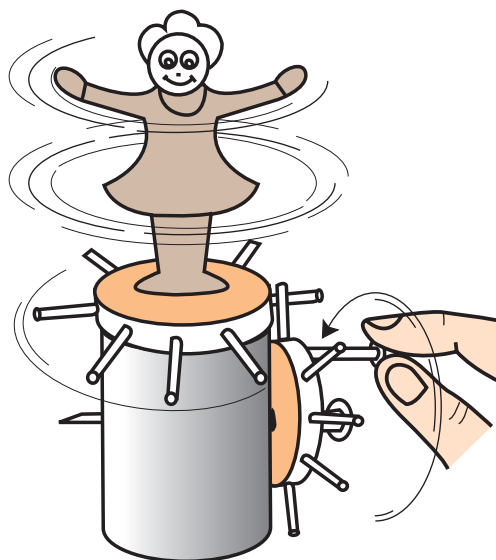
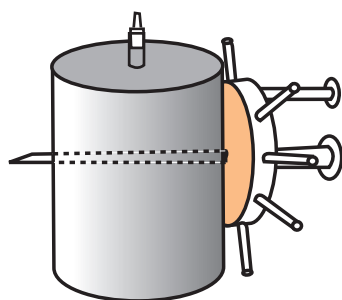


6. Cut a doll from a doubled-up card sheet and stick a refill through it. Fix this refill into the center of the other rubber disc.





7. Place this doll-disk assembly on the refill attached to the base of the case.

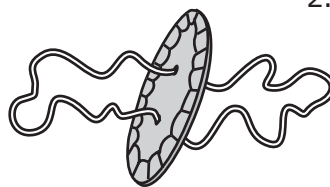


8. On rotating the handle, the vertical gear rotates. The pins of this vertical gear mesh with the pins of the horizontal gear, making the dancing doll go round and round. The driver gear moves in the vertical plane whereas the driven gear moves in the horizontal plane.

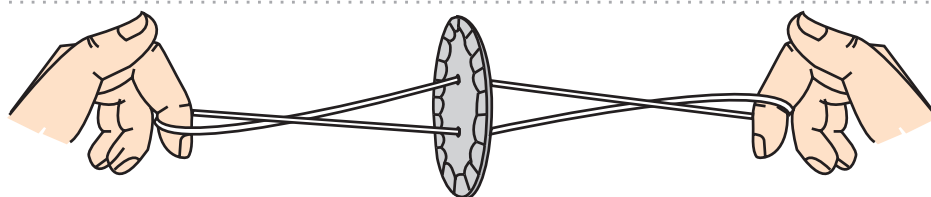
## SPINNING SODA-CAP



1. Hammer a soda bottle metal cap to make it flat. Hammer two holes with a nail in this disc. The hole should be at the same distance from the centre.

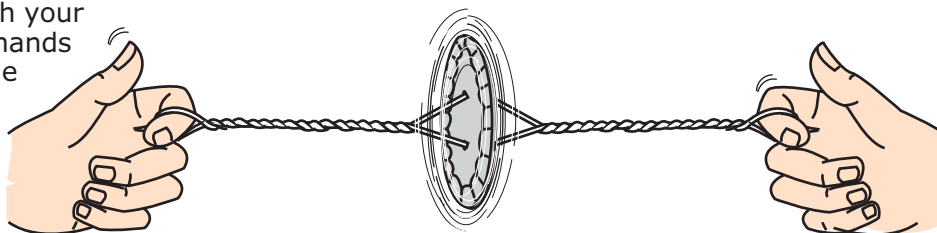


2. Take 1-metre of string. Weave the string through the two holes of the disc and tie the ends into a knot.



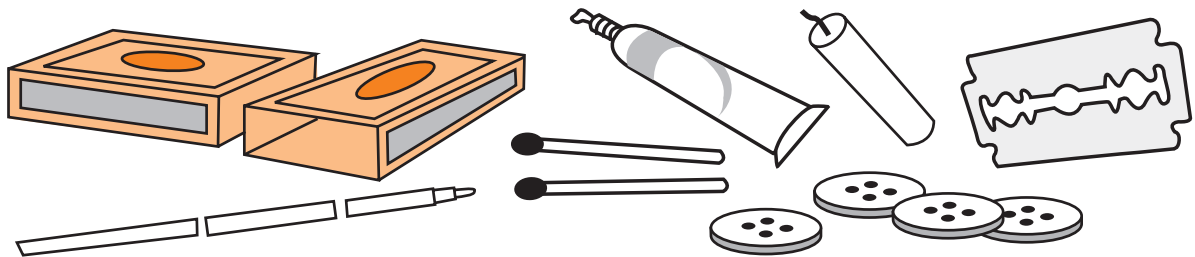
3. To wind the toy first hold the two loop ends of the string in your fingers and give it a few twists.

4. Once there are several twists on either side of the disc, quickly pull the string by moving both your hands apart. Bring your hands close again to release the tension in the string. The toy will get rewound in this process.

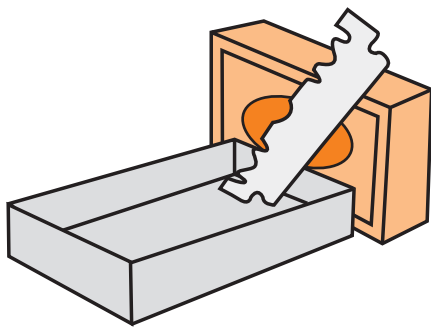


# MATCHBOX TIPPER TRUCK

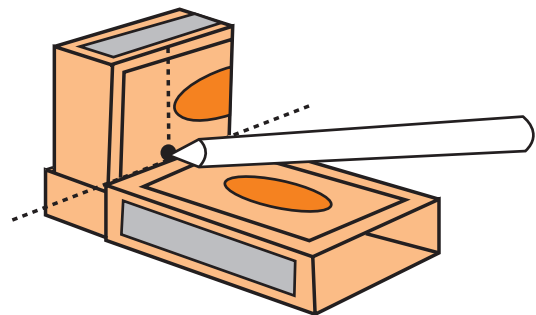
You must have seen tipper trucks unloading sand, stones or coal. You can readily make a working model of a tipper truck - incorporating several simple elements of machines like lever, fulcrum and wheels.



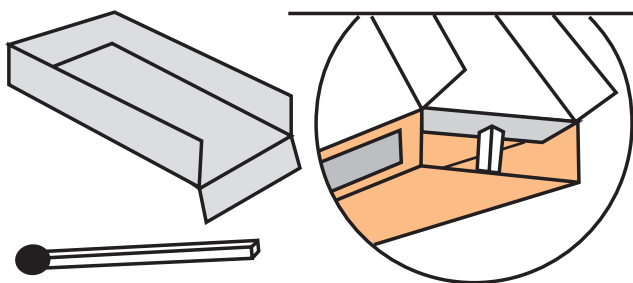
1. You will need two empty matchboxes, an old refill 2 long needles, 4 buttons, one eraser, blade, matchsticks, candle and some rubber adhesive like Fevibond or cycle puncture solution.



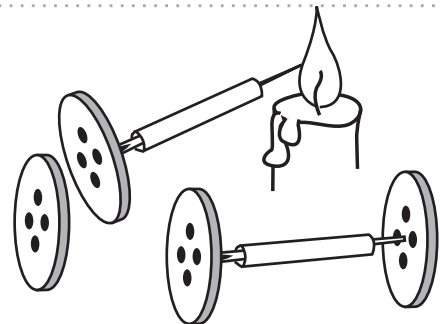
2. Take a matchbox and separate its drawer from the outer shell. Cut the outer shell so that it fits into the drawer. The cut shell becomes the DRIVER'S CABIN.



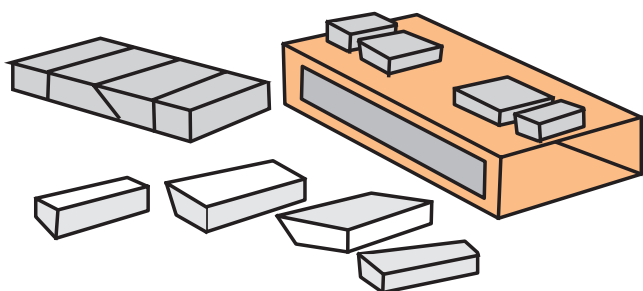
3. Make a hole in the Driver's Cabin. Slip another matchbox shell on the drawer. This will be the BODY of the tipper.



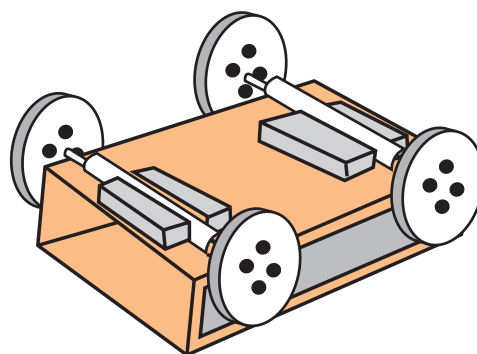
4. Take another drawer. Cut and bend its tongue into the body of the truck. You can either stick this tongue inside this body, or else you can wedge it with a piece of matchstick. This swivelling drawer makes the LOADING PLATFORM of the dumper truck.



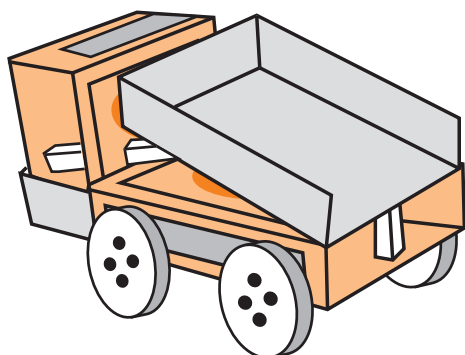
5. Make two pairs of WHEELS using cheap quality show- buttons, 2-cm long pieces of ball pen refills as bearings and long needles as axles. You need buttons, which melt with a hot needle.



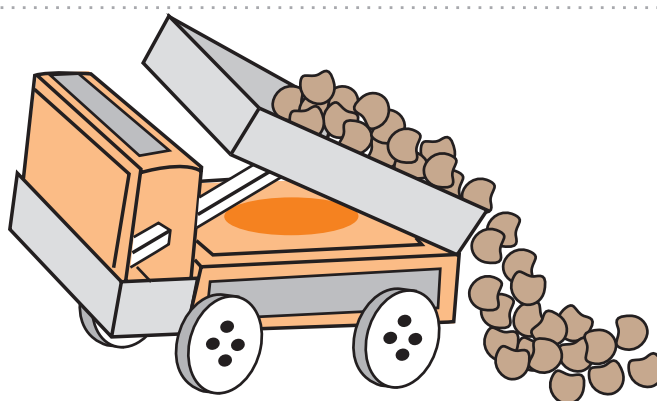
6. Cut a rubber eraser into 4 pieces. Stick these pieces in two pairs below the body. The distance between each pair should be equal to the thickness of a ball pen refill.



7. Insert the two pair of wheels between the rubber pieces.

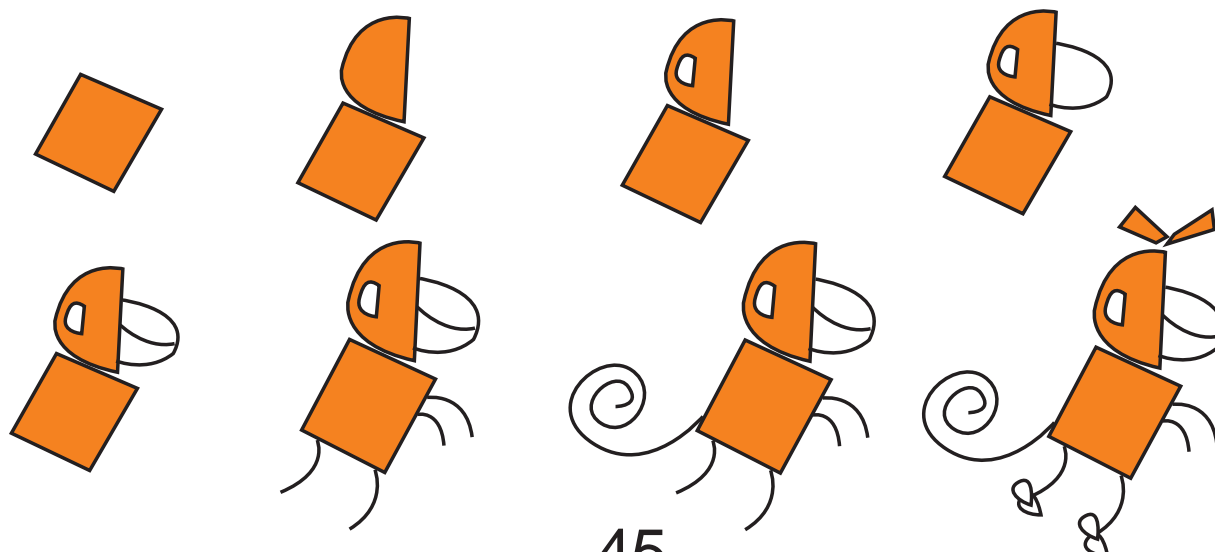


8. Insert a matchstick from the hole in the driver's cabin. The matchstick lever will act like a lever.



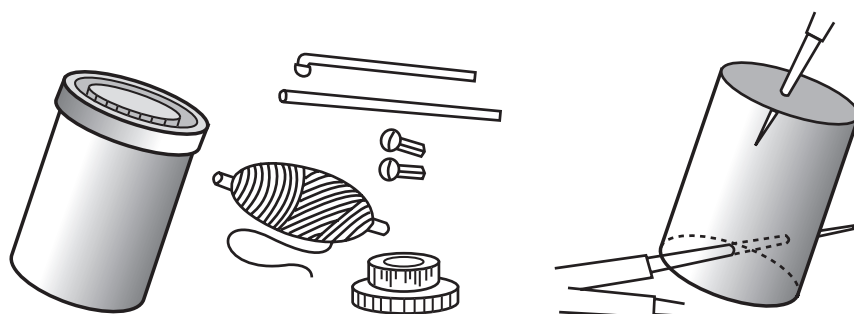
9. Load some pebbles as cargo in the truck. On pressing the matchstick lever from inside the driver's cabin, the loading platform will be raised to unload the cargo. The tipper truck will run very smoothly on being pushed.

## EASY TO DRAW

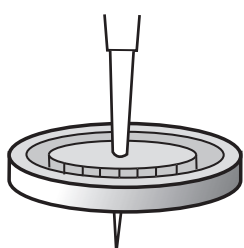


# ROTATING FAN

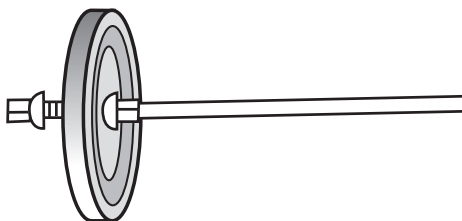
The rotating fan is based on an old traditional toy. The materials used for making this fan are a film-roll case; a cycle spoke with two nipple nuts, a rubber cap from an injection bottle and about 50 cm of strong thread.



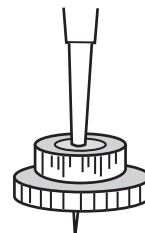
1. First make a 5 mm hole in the base center of the film-roll case. Make two holes in the cylindrical surface of the case, about 1 cm below its open mouth.



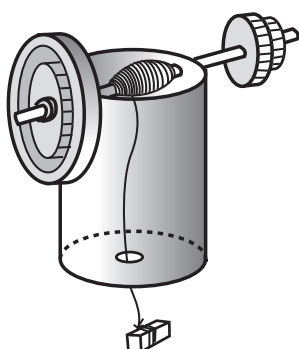
2. Pierce a divider point through the cap centre of the film-roll case.



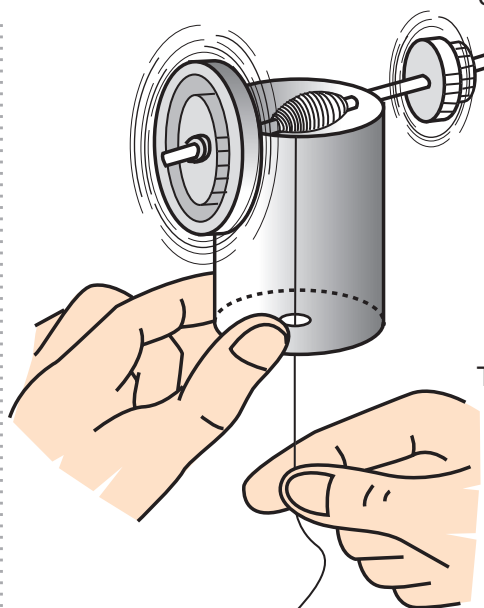
3. Cut a 7 cm long cycle spoke. Fix the case cap to the spoke's threaded end by tightening two nipple nuts.



4. Make a hole in the injection-bottle cap by using a divider point.



5. Place the spoke in the case holes and insert the injection-bottle rubber cap. The rubber cap prevents the spoke from coming out of the case. Tie the string to the middle of the cycle spoke. Weave the other end through the base hole of the case. Tie a piece of rubber at the end of the string for a good grip. Now rotate the fan so that the string loops around the spoke.

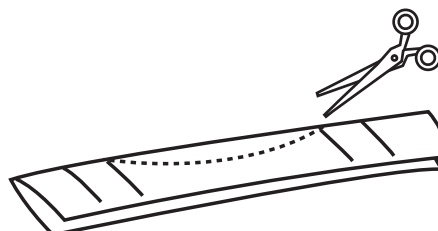
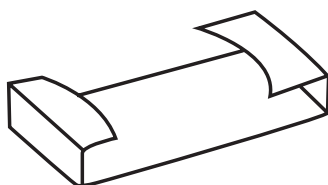


6. Pull the string downwards and then hold it loose. The fan will spin in one direction and in the process the string gets re-wound on the spoke. On pulling the string again, the fan rotates in the opposite direction.

The rotating cap acts like a fly-wheel. Because of this stored energy the fan tends to rotate even after the thread has unwrapped from the spoke. In the process the string gets re-wound on the spoke.

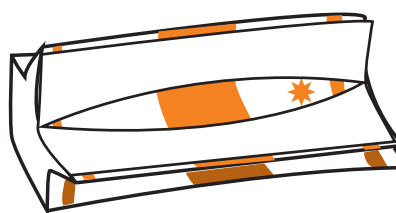
# MOUTH ORGAN

Sri Najeeb, an activist of the Kerala Shastra Sahitya Parishad (KSSP), first showed this toy to me. It is a simple mouth organ made from an old cigarette packet.



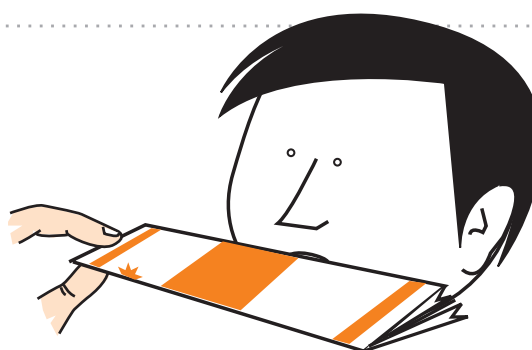
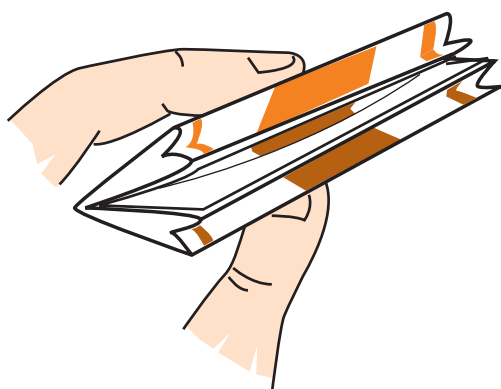
1. First remove the drawer of the cigarette packet as shown.

2. Fold it midway along the length and cut out an arc as shown.



3. Crease the midline of the sidewall so that they cave in, making a V-groove.

4. Tuck both ends of the drawer into the case as shown.

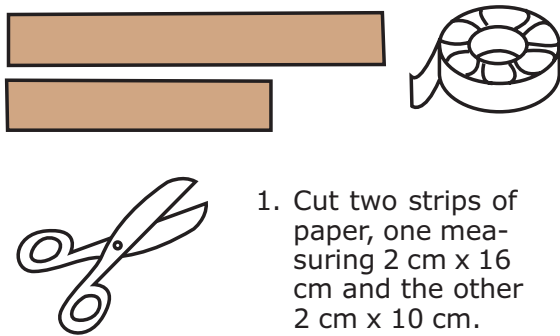


5. Now fold the outer case in the middle so that the two strips of the drawer almost meet with a very thin gap between them.

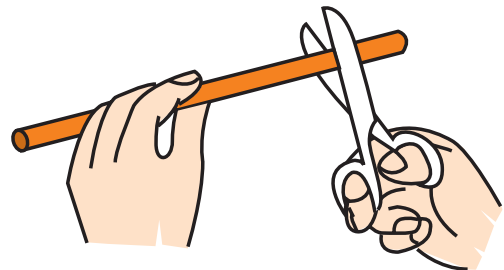
6. Place the organ gently between your lips and blow into it. You will hear a musical note. This toy is based on Bernoulli's principle, according to which when air blows at high speed between the two stripes, it creates a low-pressure zone and makes the strips vibrate. This in turn produces the sound.

# LOOP GLIDER

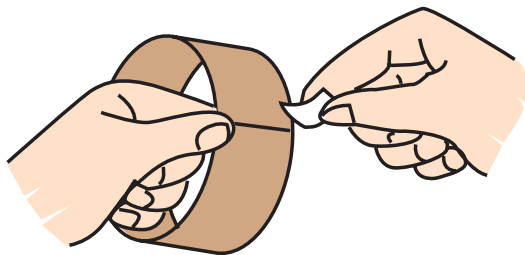
It is amazing that two paper loops fixed at the ends of a straw can glide so elegantly.



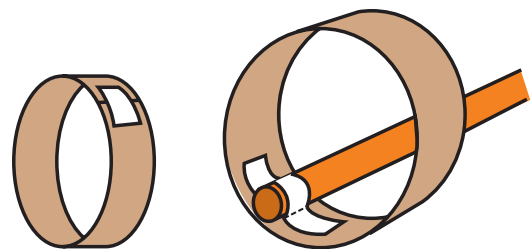
1. Cut two strips of paper, one measuring 2 cm x 16 cm and the other 2 cm x 10 cm.



2. Cut a stiff drinking straw or a light reed of 15 cm long.

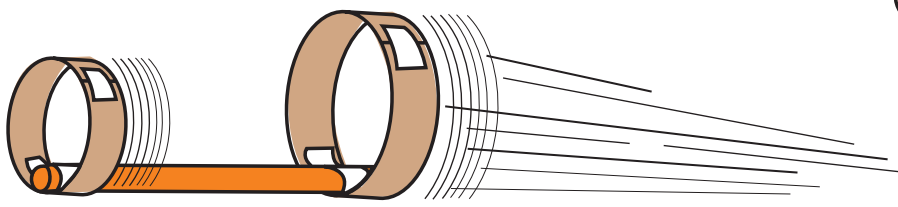
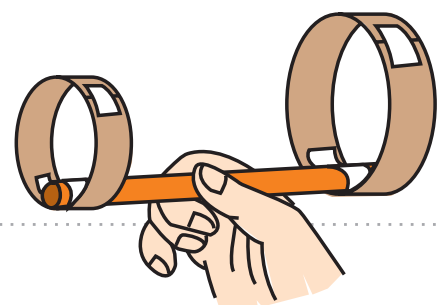


3. Bend the small strip into a loop so that its ends overlap a bit. Tape the overlapping ends together. Do the same with the large strip.

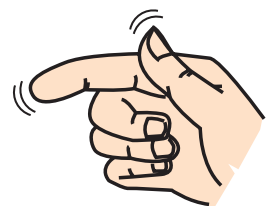


4. With a piece of sticky tape attach the small loop to one end of the straw.

5. Attach the large loop to the other end.



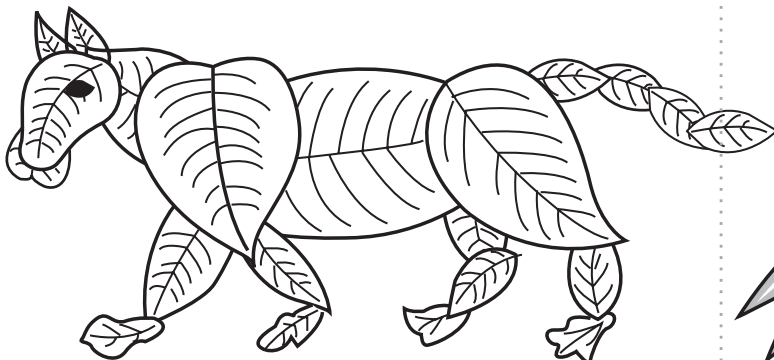
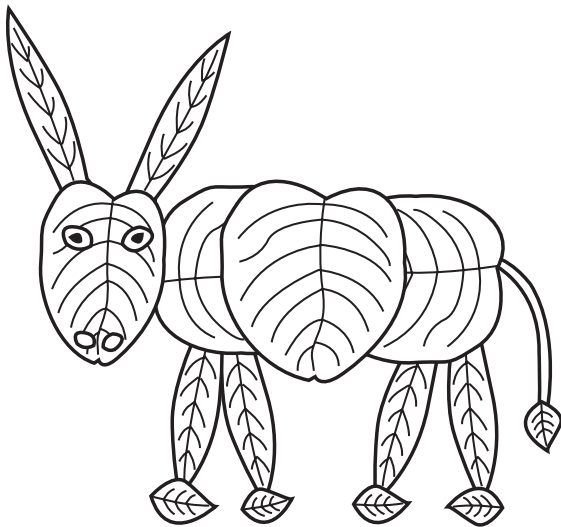
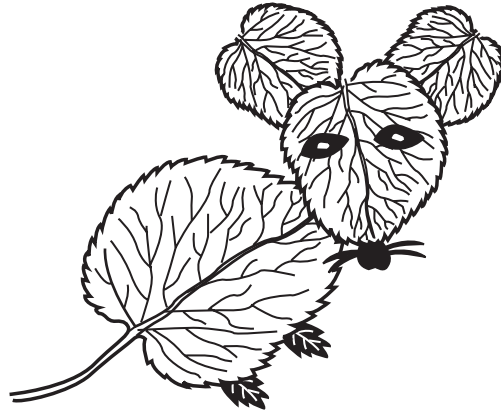
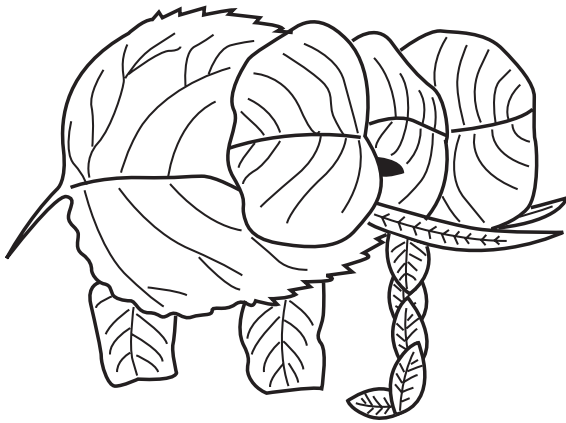
6. To fly the glider, hold it high with the small loop in the front and throw gently. The loop glider will glide through the air. If the glider wobbles, adjust the position of the loops.



# LEAF ZOO

People, Banyan, Mango, Rose  
Each has a distinctive pose  
One's beak, another a claw  
This a stomach, that a paw

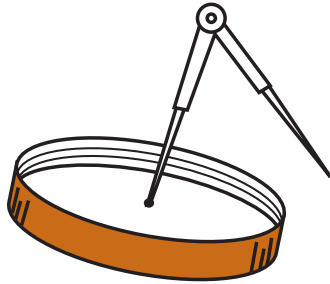
Stick them neatly with same glue  
And after you have made a few  
Go ahead, discover some more  
How about trying a dinosaur?



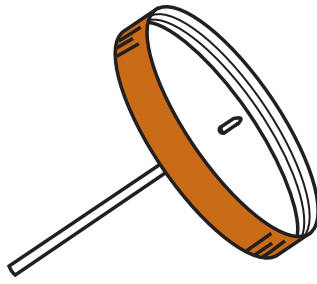


# SILENT MOTION FILM

Here is another way of making a short, soundless motion film.



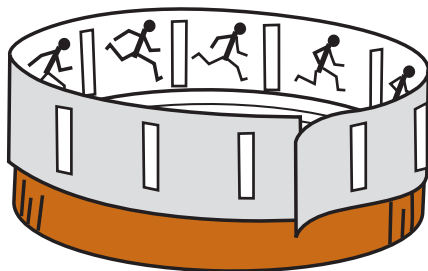
1. Take an old plastic jar lid approx. 10 cm in diameter and make a hole in its center with a divider point.



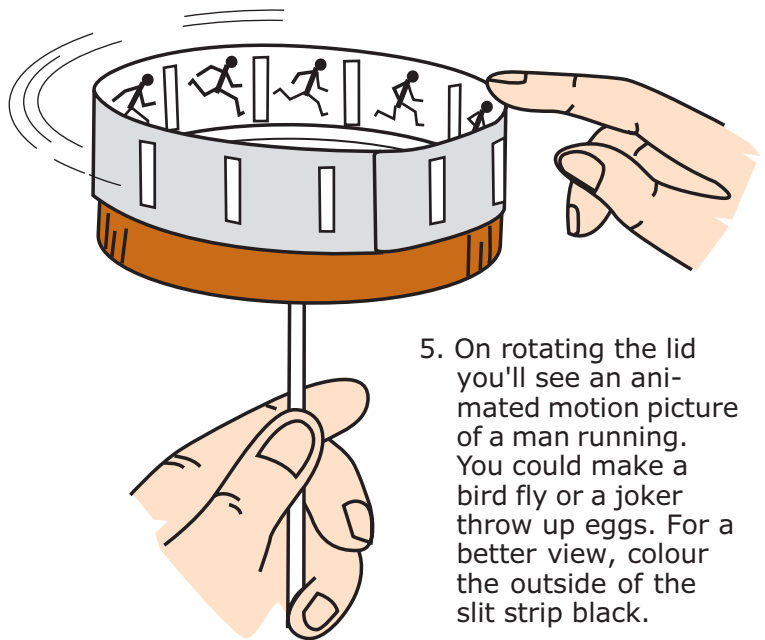
2. Insert the brass tip of a ball pen refill in this hole. The jar lid should rotate smoothly on the refill tip pivot.



3. Cut a strip of card sheet long enough to go around the circumference of the lid. Draw gradually changing pictures on this strip. Cut slits between the pictures.

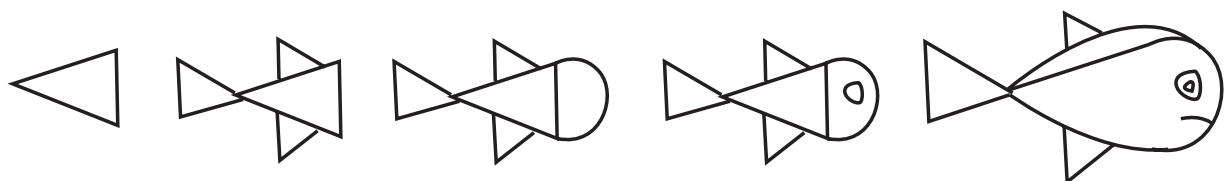


4. Glue the strip on the rim of the lid with the pictures inside.



5. On rotating the lid you'll see an animated motion picture of a man running. You could make a bird fly or a joker throw up eggs. For a better view, colour the outside of the slit strip black.

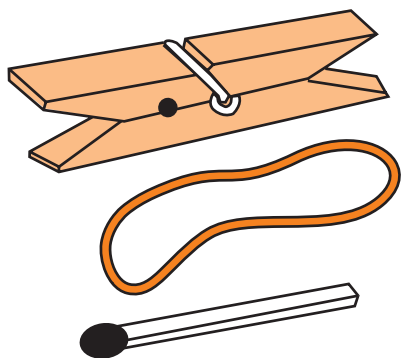
## EASY TO DRAW



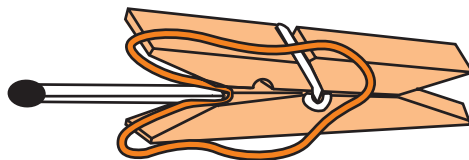


# CLOTHES CLIP PISTOL

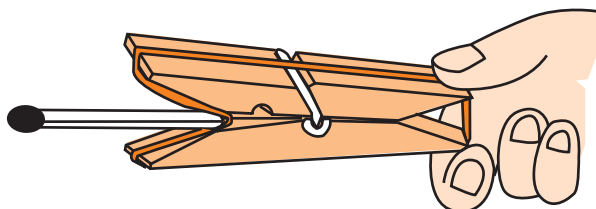
This fun pistol could throw a match stick several feet away.



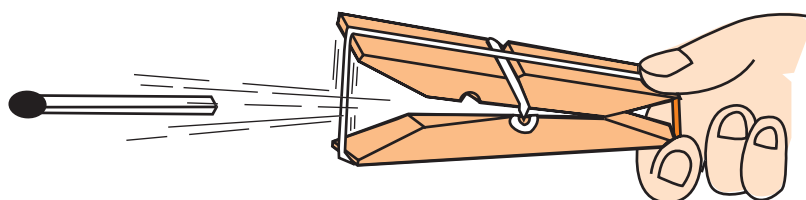
1. To make this ingenious pistol you will require a wooden or a plastic clothes clip, a rubber band and a matchstick.



2. Place the matchstick and the rubber band as shown in the picture.

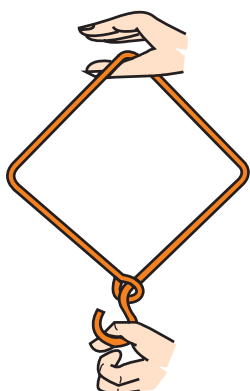


3. The rubber band will be in tension. If you press the clip in this position then...

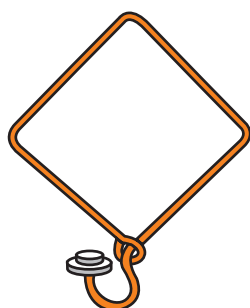


4. The matchstick will shoot forward. A wooden clothes clip and a thicker stick works better.

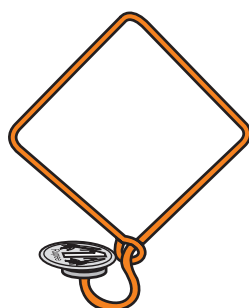
# FUNNY MONEY



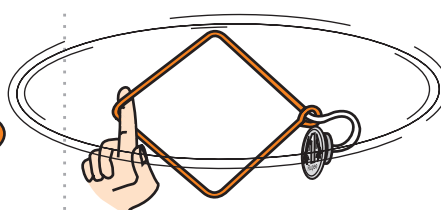
1. Pull an aluminium hanger into a diamond shape.



2. Make a hole in an injection bottle cap and insert it in the hook.



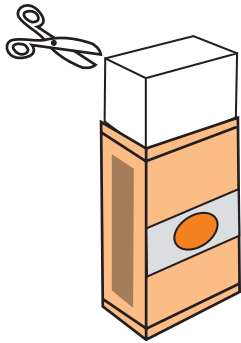
3. Place a coin on the rubber cap. Swing the hanger in a full circle. Continue spinning fast. The coin will not fall



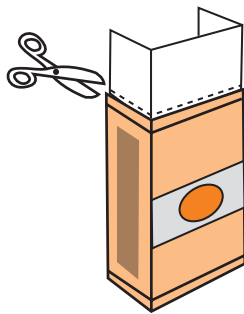
4. When you stop the coin will still be perched on the cap. This is a very dramatic way to demonstrate centripetal force.

# SWINGING ACROBAT

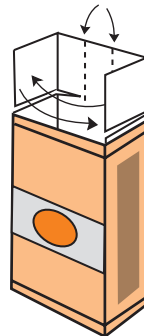
You will need: two empty matchboxes two wood battens, about 2 x 25 cm, string, scissors, nail, glue, sticky tape, pencil, ruler and colouring materials.



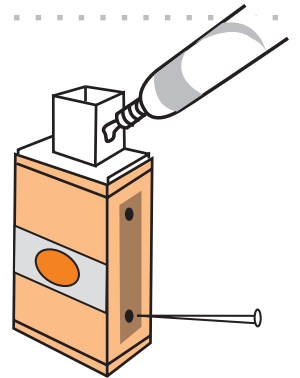
1. Push part of one matchbox tray from its casing and cut away the end.



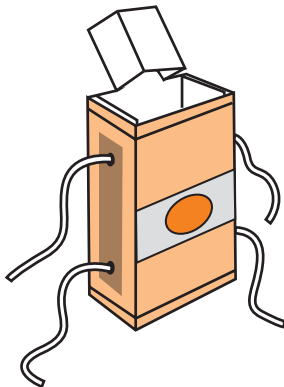
2. Cut into the sides of the tray, above the edge of the casing.



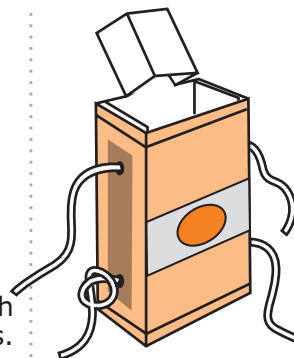
3. Bend the bottom of the tray as shown, so that the side flaps overlap....



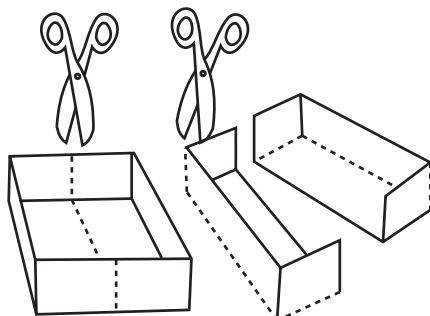
4 ....and fasten them together with a spot of glue. This forms the acrobat's head. Now make two holes in each side of the box with a nail.



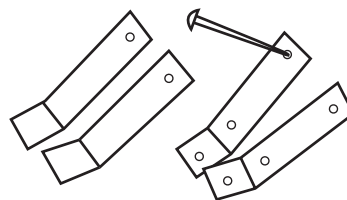
5. Cut two pieces of string at least 12-cm long. Neatly wrap a small piece of sticky tape around one end of each (to stop the ends from fraying), and thread one through the top two holes and one through the bottom two holes.



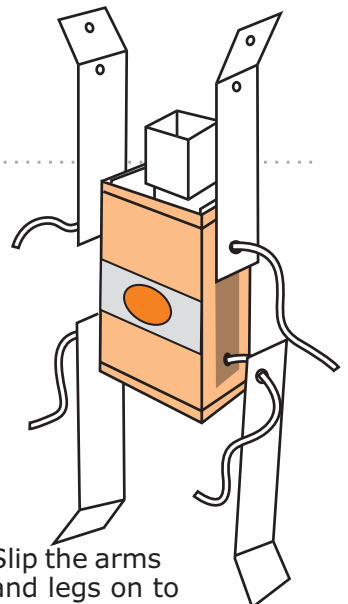
6. Tie a knot in each protruding end, close to the side of the box.



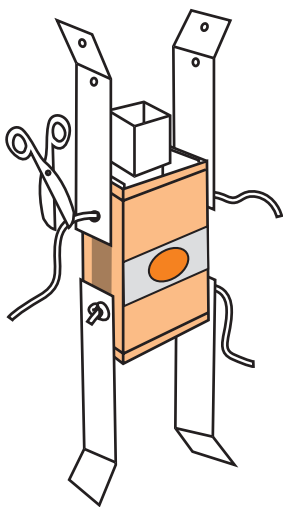
7. Take the tray from the other empty matchbox and cut it in half lengthwise.



8. Then cut each half as shown to make four similar pieces. These will become the acrobat's arms and legs. Pierce a hole in one end of each as shown. In two of the pieces, pierce another two holes, 1-cm apart, at the other end.



9. Slip the arms and legs on to the string ends. Tie a knot in each string close to the arm or leg....

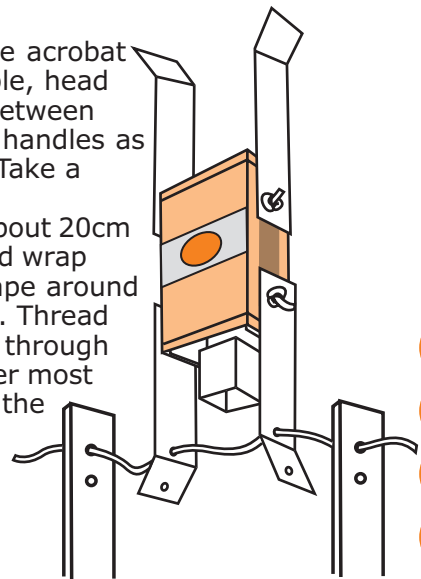


10.... and cut off any surplus.

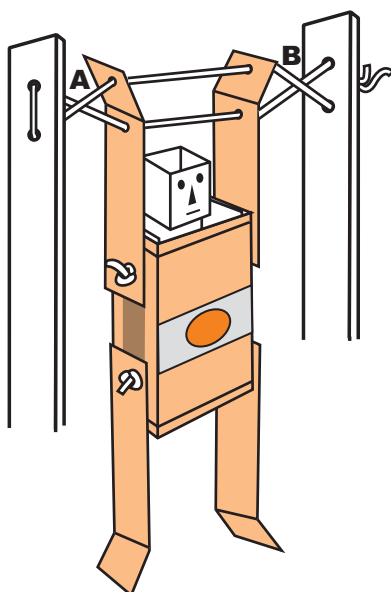
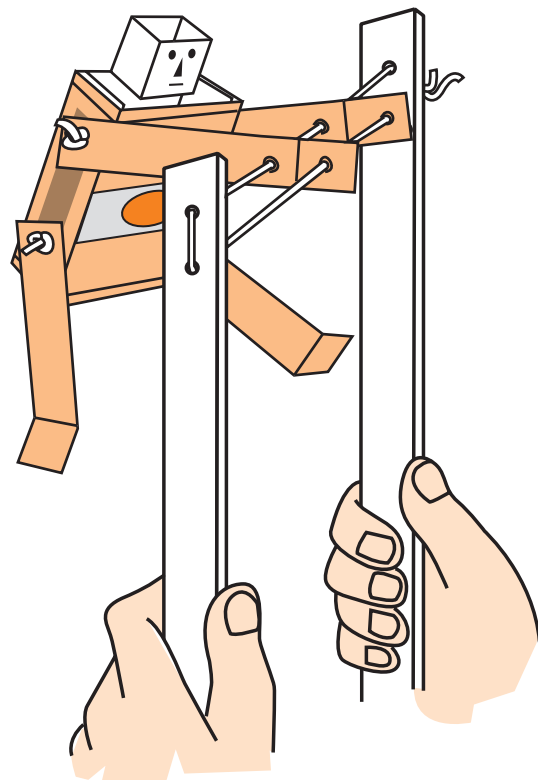
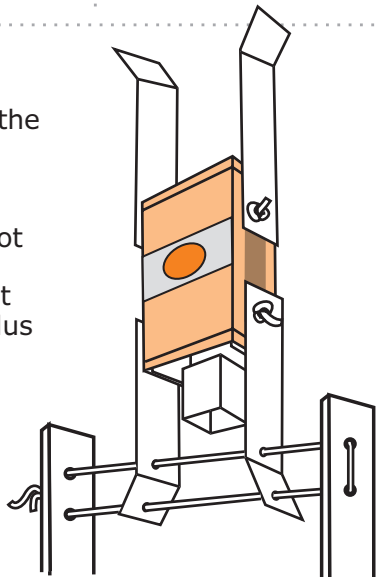
11. Prepare the handles by piercing two holes, 1-cm apart, in one end of each of your bat-tens



12. Place the acrobat on a table, head down, between the two handles as shown. Take a piece of string, about 20cm long, and wrap sticky tape around one end. Thread this end through the upper most holes in the handles and arms...



13.... then take the string back through the lower holes and tie a knot to complete the loop. Cut off any surplus string.



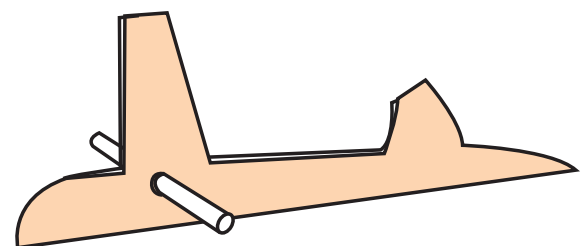
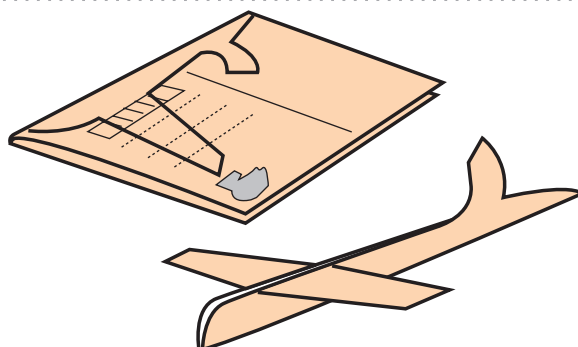
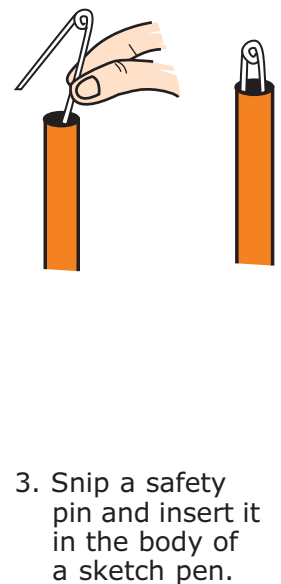
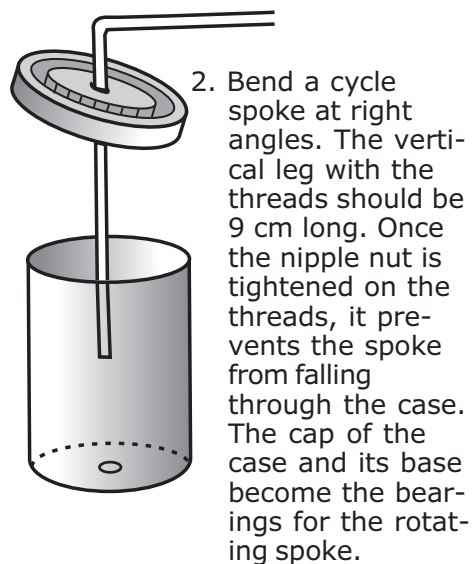
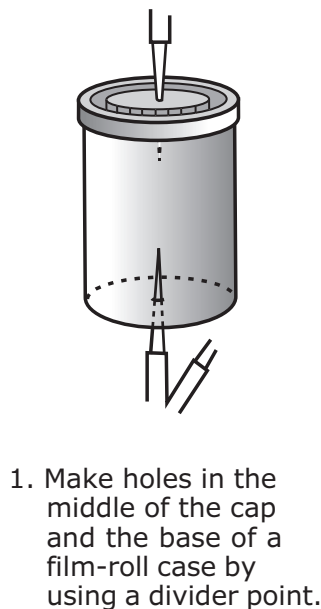
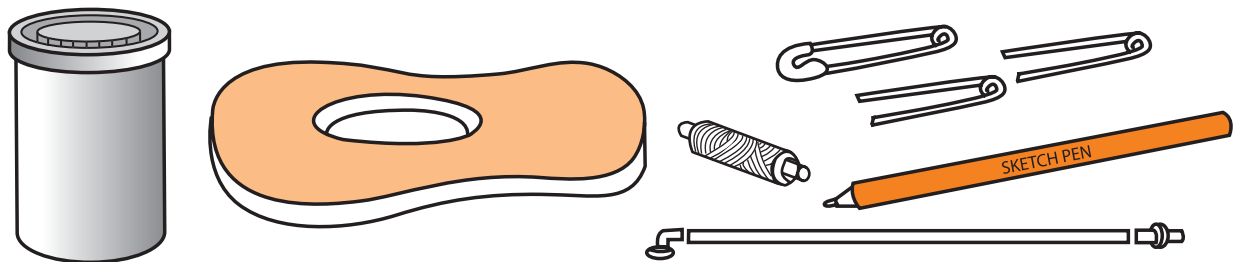
14. Bring down the acrobat to lie between the handles. Draw in the face and perhaps a colourful costume.

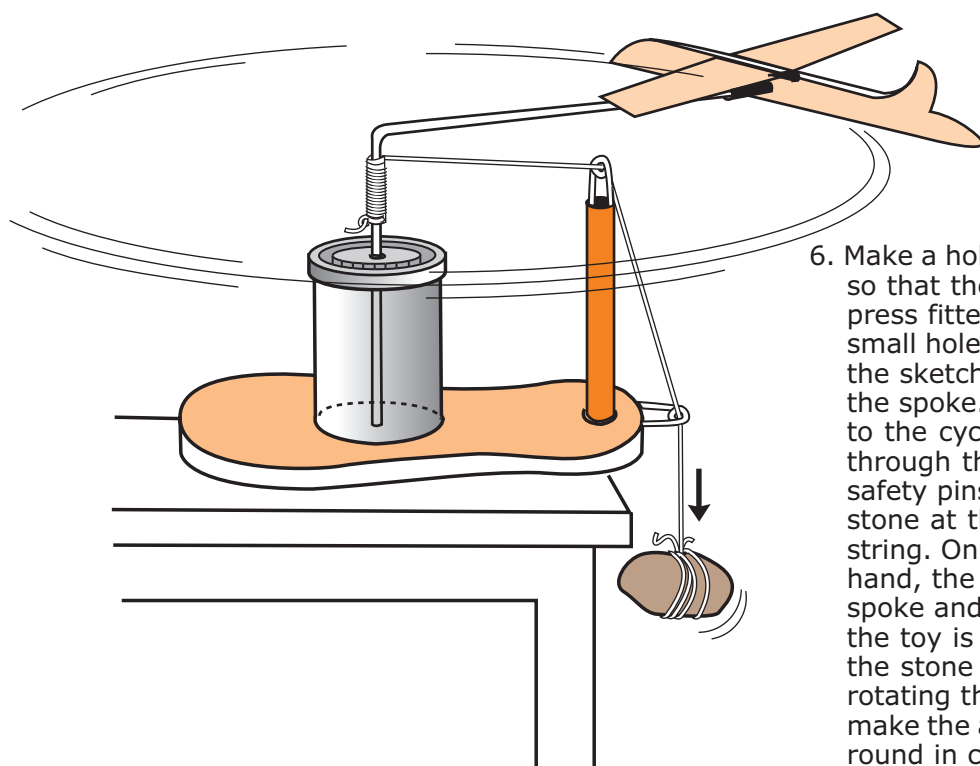
15. Pull the two handles apart and the acrobat should swing up and around with his legs flying.

**IMPORTANT:** Before using this toy make sure the strings are crossed at points A and B as in fig 14. Sometimes the strings become twisted, or crossed the wrong way, and this prevents the toy from working properly.

# CIRCLING AIRPLANE

On winding this toy, a small airplane can be made to go round and round in circles. It is based on the principle of conversion of potential energy into kinetic energy.

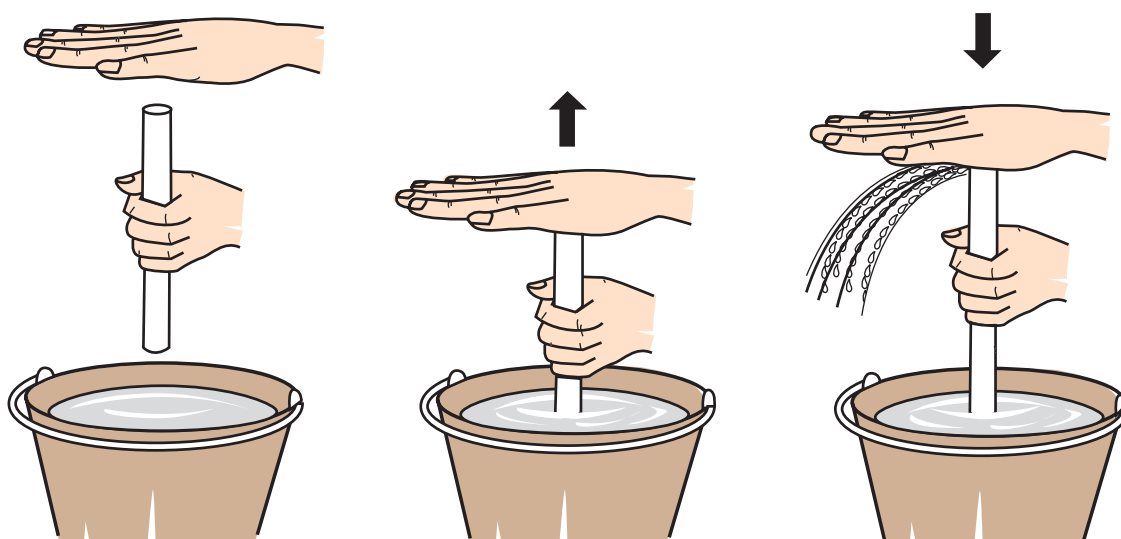




6. Make a hole in an old rubber slipper so that the film-roll case can be press fitted into it. Make another small hole in the slipper to press fit the sketch pen. Fix the airplane to the spoke. Tie a 25 cm long string to the cycle spoke. Weave it through the eyelets of the two safety pins as shown. Tie a small stone at the other end of the string. On rotating the airplane by hand, the string gets wound on the spoke and the stone is raised up. If the toy is now kept on the table, the stone descends slowly, thus rotating the vertical spoke. This will make the airplane go round and round in circles, to the utter delight of your friends!

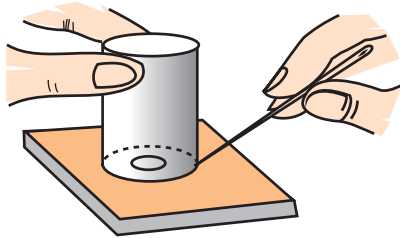
## INERTIA PUMP

This simple pump was designed by Suresh Vaidyarajan. Any hollow tube - PVC, metal or even a 30 cm long Papaya stem can be made to pump up water. Hold the tube with your left hand and move it up and down into a bucket of water. Keep the palm of your right hand on the top of the tube and open and close it with each up and down reciprocation. Soon water will start squirting out. Here the up-down motion of the left hand does the pumping while the right palm acts like a valve.

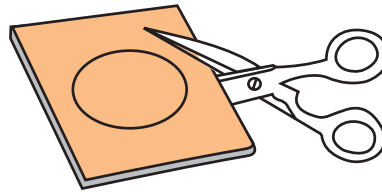


# PUMP FROM THE DUMP

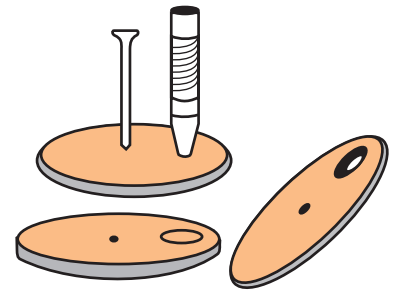
This pump too consists of a piston, cylinder and two valves all salvaged from odds and bits. With each up and down movement of the piston water will leap out in large gushes and delight you no end.



1. The PISTON is made out of 3 to 5 mm. thick rubber slipper sole. Place a film roll bottle on this rubber and mark out the circle of the piston.



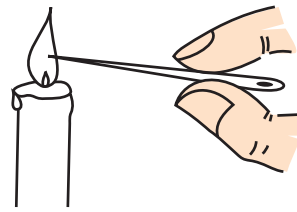
2. Cut it with a scissors and then sandpaper its rim on a cement floor until it goes snugly into the film roll bottle cylinder.



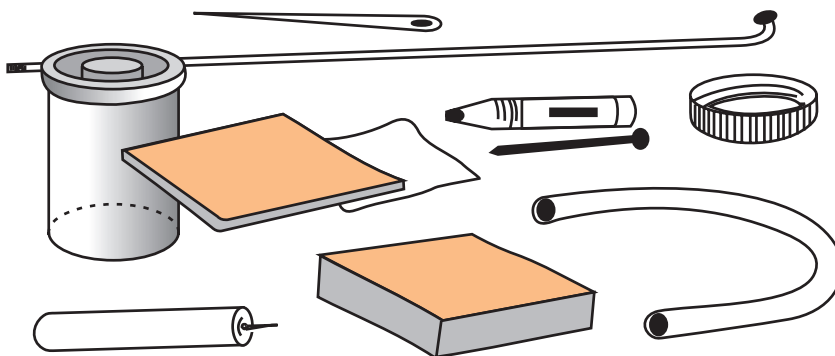
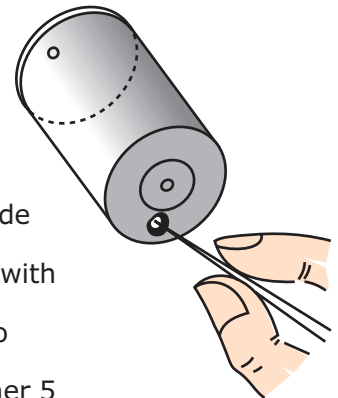
3. Make a hole in the center of the piston with a nail. Make another hole leaving a margin of 4 mm from the rim. This hole should be 5 mm in diameter.



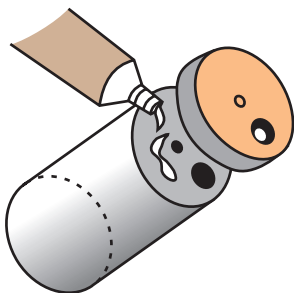
4. Stick a plastic milk bag flap on one side of this hole. This is the delivery valve. Press fit a cycle spoke in the central hole of the piston. The cycle spoke connecting rod will move the piston up and down.



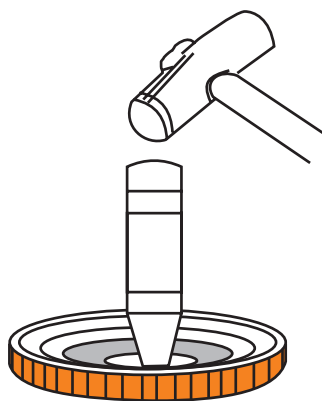
5. The CYLINDER is made of a plastic film roll bottle. Make a hole with a hot needle in the centre of its base to enable the spoke to pass through. Another 5 mm hole is made in the base near the rim for the water outlet.



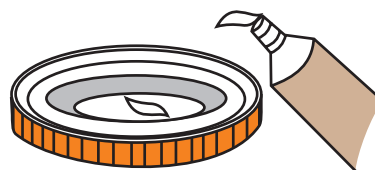
6. A 5 mm thick slipper rubber is cut to fit the circular base of the bottle. A hole is made in its center to enable the spoke to come out.



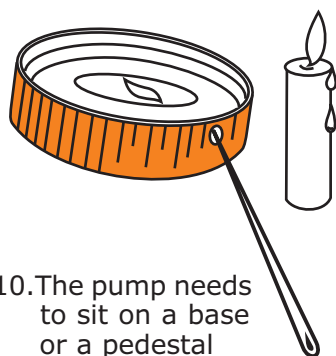
7. Another hole is made in this rubber gasket corresponding to the water outlet. This rubber gasket stuck on the base of the bottle acts as a support for the spoke and also prevents leakage.



8. The SUCTION VALVE is made by punching a 6 mm hole in the center of the bottle cap.

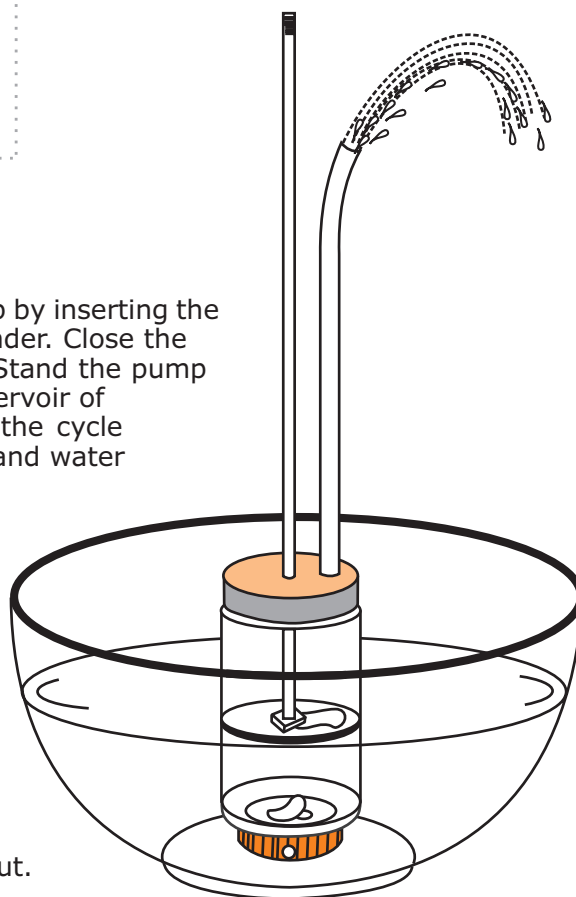


9. A milk bag flap is stuck to one side of this hole using rubber solution. The milk bag strip acts as a 'flap valve' opening and closing the hole and letting water flow in only one direction.

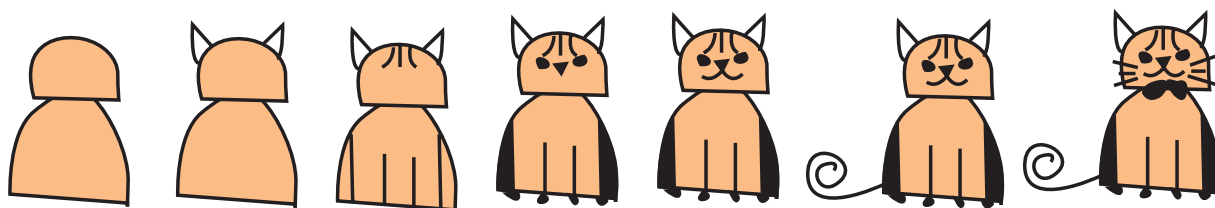


10. The pump needs to sit on a base or a pedestal otherwise its suction valve will get choked. Make 3 holes on the serrated rim of a poster color bottle cap with a hot needle. The cap makes a sturdy base for the pump.

11. Assemble the pump by inserting the piston into the cylinder. Close the suction valve cap. Stand the pump on its base in a reservoir of water. Reciprocate the cycle spoke a few times and water will gush out of the delivery pipe. Both the valves open upwards. You can see the valves open and close like a fish's mouth. This working model of an actual pump does not have a handle like a real hand pump. You'll have to rack your brains to figure it out.



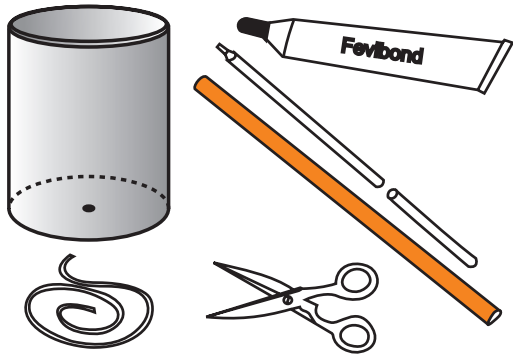
## EASY TO DRAW



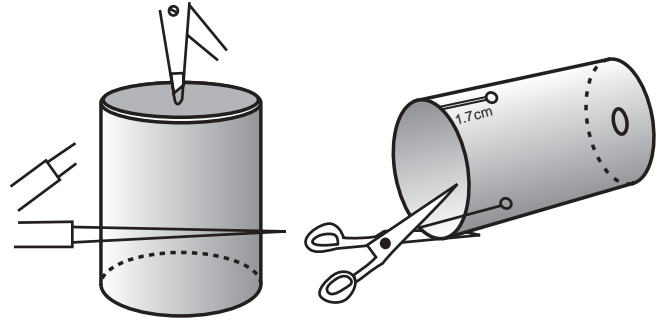


# CRANKY DOLL

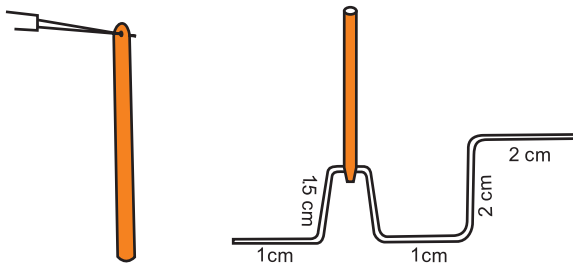
As you rotate the handle of this little machine, the doll on top jumps up and down.



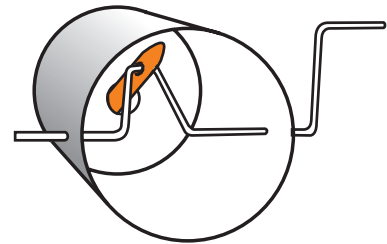
1. This cranky doll can be easily made by using a film-roll case, a thick straw, a thin wire of length 12 cm, a refill, a card sheet, glue and some hand-tools.



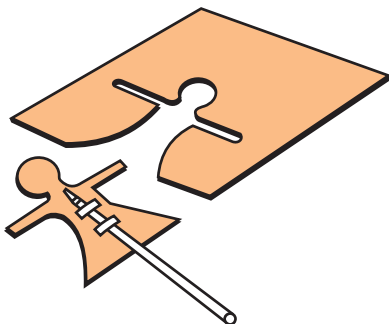
2. Using a divider point, make two holes in the cylindrical surface of the film-roll case, at a distance of 1.7 cm from the open end. Make an 8 mm wide hole at the center of the bottle base. Use scissors to make straight cuts from the mouth of the case to the holes.



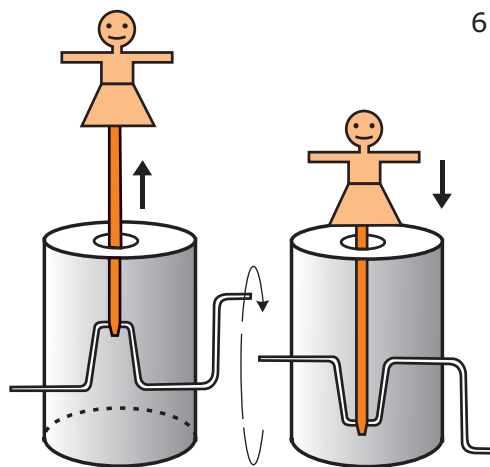
3. Take a thick straw of length 5 cm and with a divider make a hole at one end. Also bevel cut the corners of this end. Take a thin wire of length 12 cm and bend it like a U-shaped crank and handle as shown.



4. Slip the straw in the crank. Gently slip the wire crank through the cuts in the holes by pressing the mouth of the case. The straw will come out of the base hole of the case.



5. Cut the outline of a doll from a card sheet. Affix a small ball-pen refill to the doll. Slip this refill into the straw.

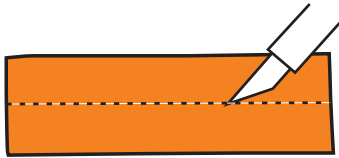


6. Now, as you rotate the handle, the U-shaped crank moves in a circle, making the straw move up and down. The doll, which is attached to the straw, also jumps up and down. The pistons of a car engine move up and down inside the cylinder. This makes the crankshaft go round and round. In our small machine the rotary motion of the handle gets converted into the straight-line motion of the straw.

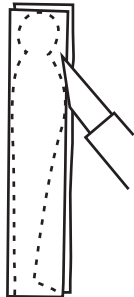


# BOXERS

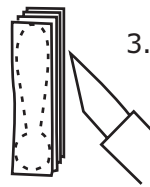
You will need: thick card or soft wood, thin card, craft knife, nail, string, pencil, ruler and sketch pens.



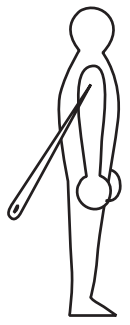
1. Cut the thick card or balsa wood into two 3 x 20 cm strips.



2. Prepare two 3 x 15 cm strips of thin card. Draw a simple side-view of a man on each, filling up as much of the space as you can, and cut them out.

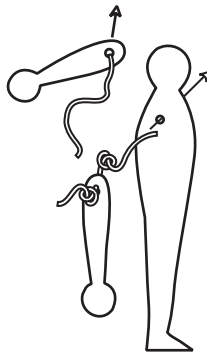


3. Prepare four 1.5 x 6 cm strips of thin card and draw the shape of an arm, with boxing glove, on each. Cut them out.

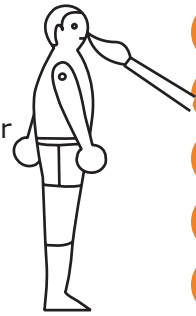


4. Place a cut-out arm on each side of one man and use the nail to pierce a hole through both the arms and body.

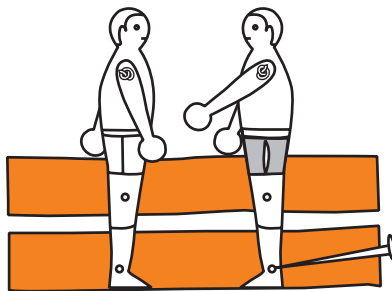
5. Wrap a piece of sticky tape around one end of the string and thread it through the hole in one of the arms and tie knots in the string close to the arm on either side. Thread the string through the body and tie another knot. Thread through the other arm and tie a final knot.



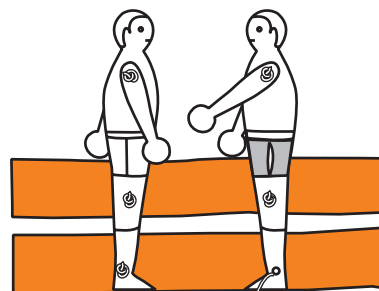
6. Make sure the arms swing freely and then trim off the surplus string. Draw and colour the man to make him look like a boxer. Repeat steps 4-7 with the other pieces.



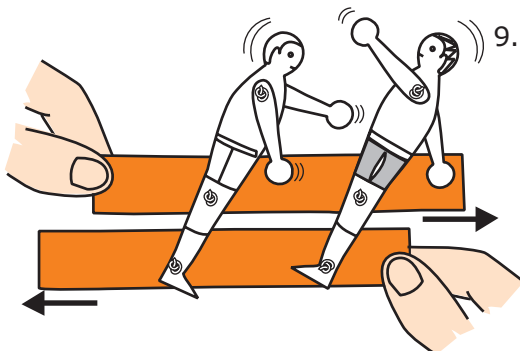
7. Place the two strips of thick card or soft wood on a flat surface 1 cm apart, one above the other. Place the two boxers on these strips, 5 cm from the left and right edges.



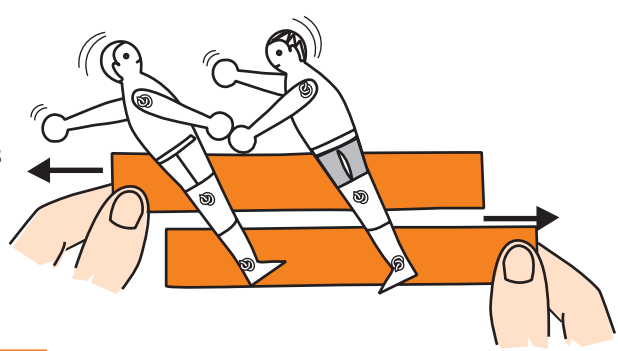
Make sure that they face each other and that their feet rest on the bottom edge. Pierce holes through their ankles and thighs and the supporting strips behind. These should be about 1 cm above the lower edge of each strip.



8. Join the boxers to the supporting strips by threading string through each of the holes and tying knots in front and behind. Trim off the surplus string.

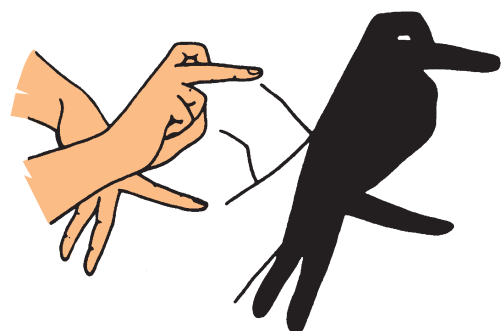
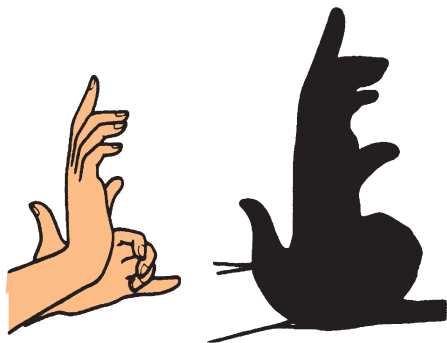
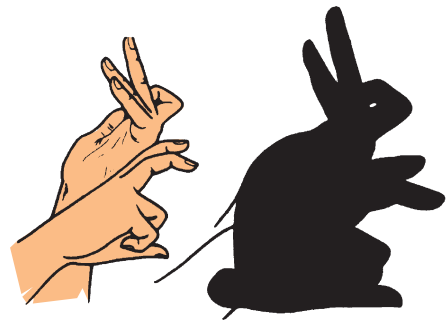
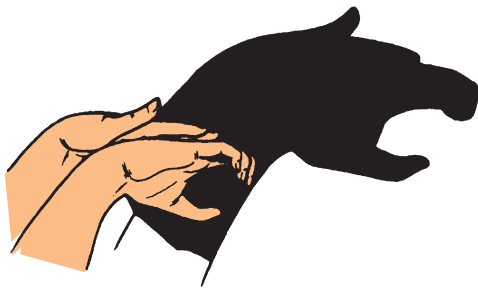
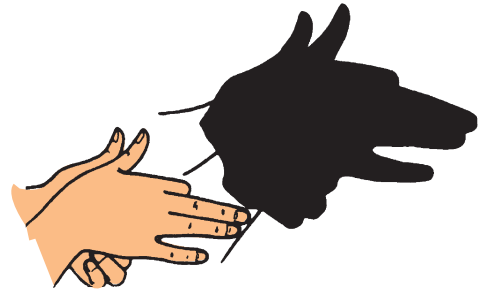
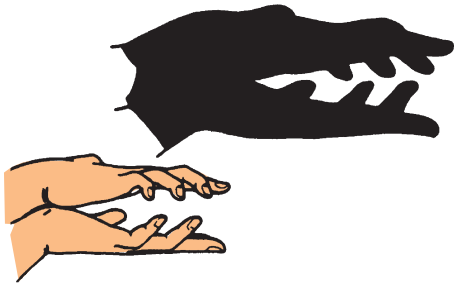


9. Hold the strips at either end, and move them from side to side. The boxers will fight with their arms swinging.



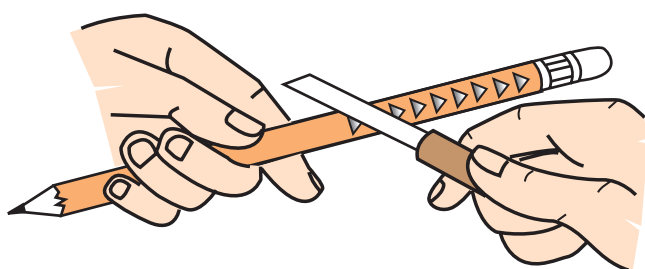
# HAND SHADOWS

Making shadow pictures is great fun. All you need is an electric light without a shade and a sheet. To throw shadow picture on the sheet you must have your hands between the light and the screen. You will have to adjust your hands and fingers to make interesting and convincing pictures on the screen.



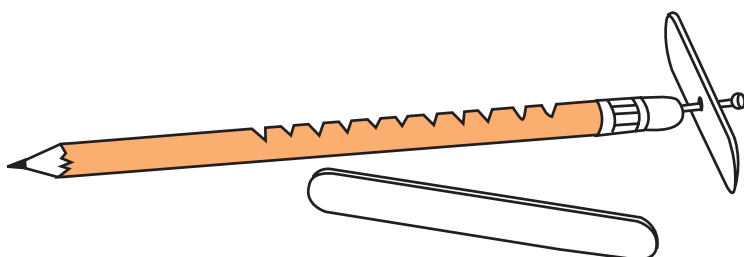
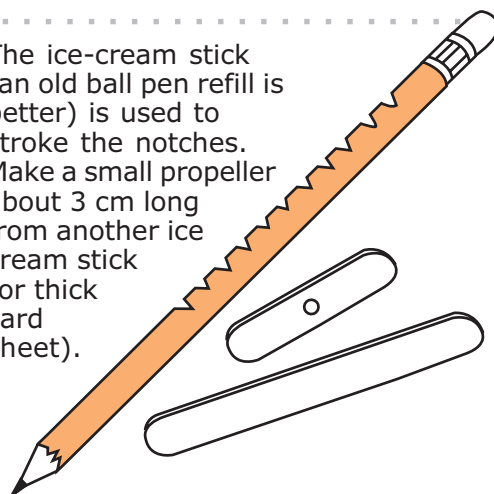
# MAGIC WINDMILL

This windmill is essentially a propeller on a notched stick. Its working has puzzled and baffled people for over a century.

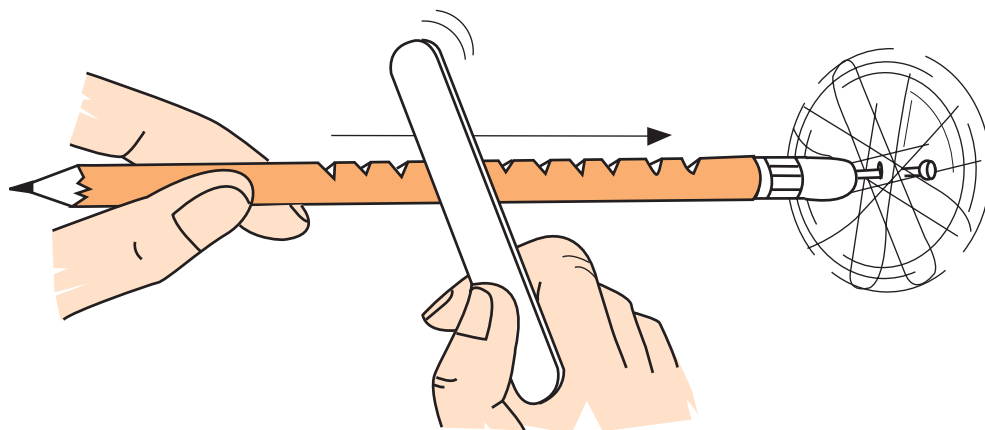


1. Take a 25 cm long reed stick, or even a used sketch pen or a pencil with a rubber on one end will do. Cut 5-6 notches on it using a knife or a triangular file.

2. The ice-cream stick (an old ball pen refill is better) is used to stroke the notches. Make a small propeller about 3 cm long from another ice cream stick (or thick card sheet).



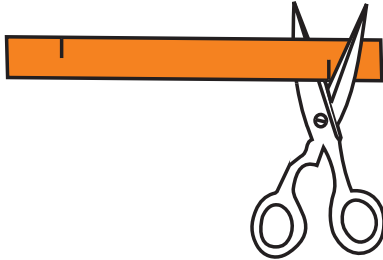
3. Put a loose pin or nail through the propeller hole and fix it at the end of the notched stick.



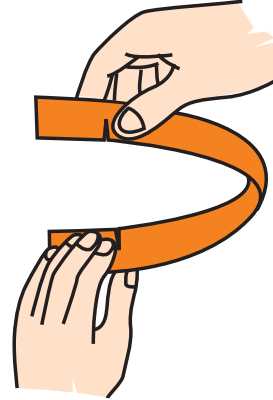
4. Holding your forefinger on the far side of the notched stick and your thumb on the near side, stroke the ice-cream stick back and forth on the notches. The propeller will turn in one direction. Now loosen your forefinger and let your thumb press against the stick, stroking the stick back and forth all the while. The propeller will now turn in the opposite direction. The horizontal and vertical vibrations of the notched stick are not the same frequency and amplitude. The resulting vibrating motion of the stick and thus of the pin is elliptical. Depending on the finger pressure and the side, which is rubbed, these elliptical vibrations can be clockwise or anticlockwise. The friction between the pin and the propeller sets the propeller in motion.

# FLYING FISH

This is the simplest and the most amazing flying object that you can make. The fish will twist and turn round and round as it comes to the ground.



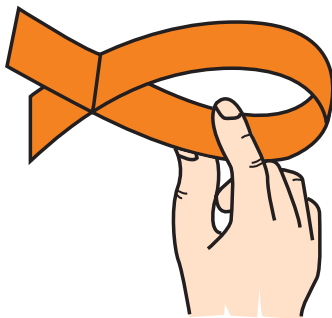
1. To make it all you need is a strip of old newspaper. The strip should be 2 cm wide and about 12 cm long. Place the strip in a horizontal position. On the lower right-hand side, about 1.5 cm. from the end, cut a slit half-way across the strip.



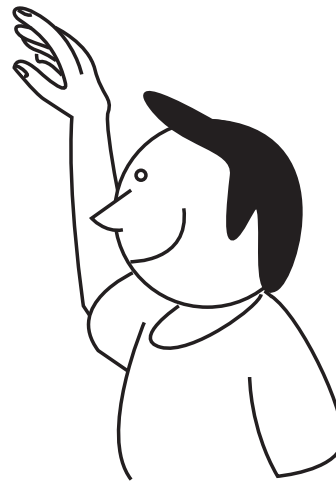
2. Make a similar cut on the upper left-hand side.



3. Slip both the slits into each other so that they interlock together.

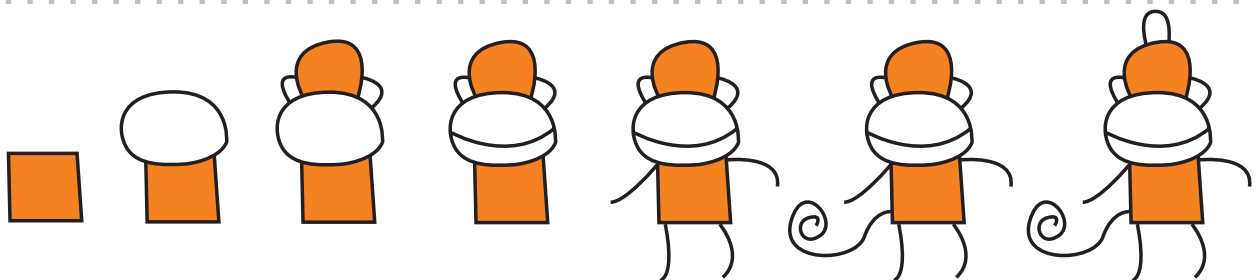


4. The fish is now complete.



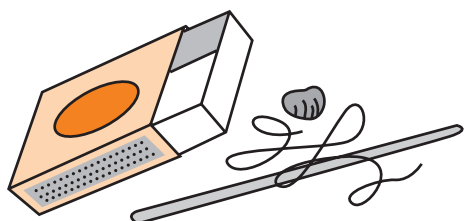
5. Throw it high in the air and it will twist and turn around on its way to the ground. Try making Flying Fishes of various sizes and colours. This is the simplest and the most amazing flying object that you can make. The fish will twist and turn round and round as it comes to the ground.

## EASY TO DRAW

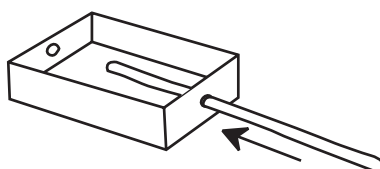


# MATCHBOX DRUM

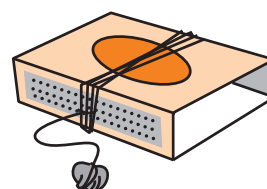
This sound toy is easy to make. Small children like it very much.



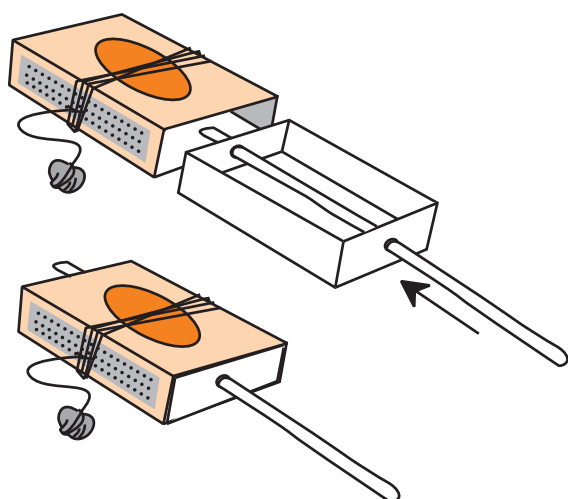
1. You will need an empty matchbox, a bamboo stick, a piece of string, a small stone.



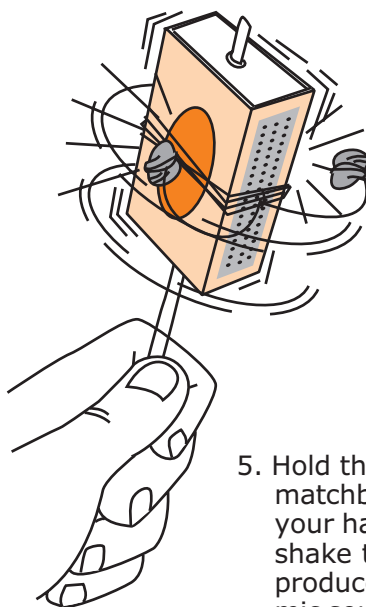
2. Make a hole on each of the two ends of the matchbox. Fix a stick vertically as shown.



3. Tie one end of the thread around the box to fix the sticks. Tie a stone at the other end.

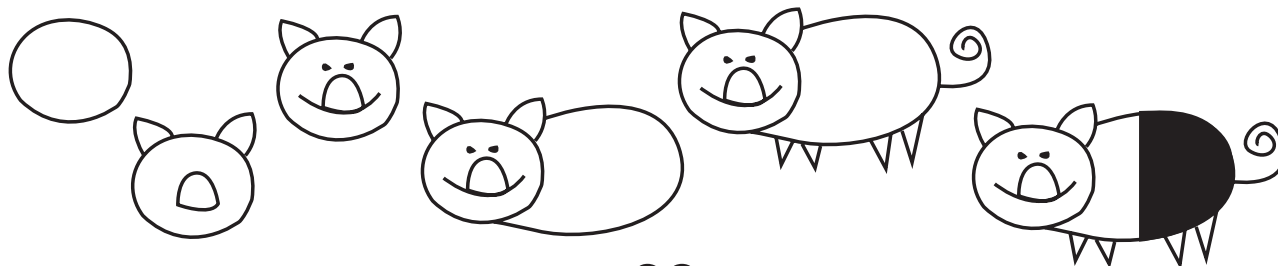


4. Adjust the string length so that the stone strikes the broad surface of the matchbox.



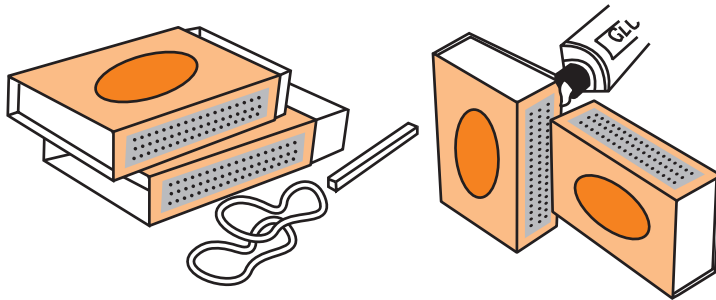
5. Hold the matchbox in your hand and shake to produce rhythmic sounds.

## EASY TO DRAW

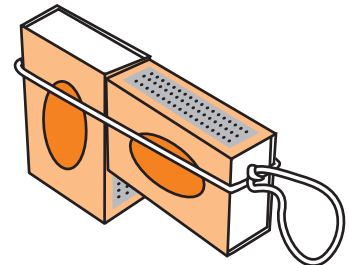


# MATCHBOX PISTOL

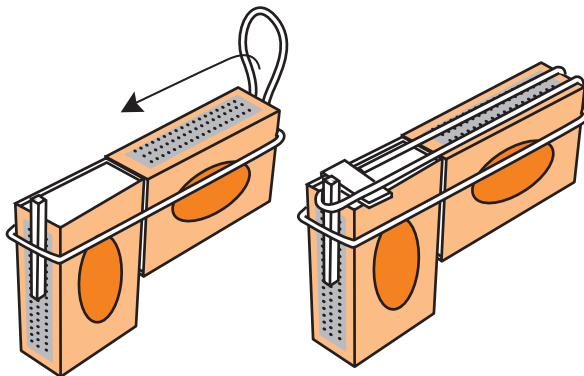
On releasing the rubber band the bullet flies off.



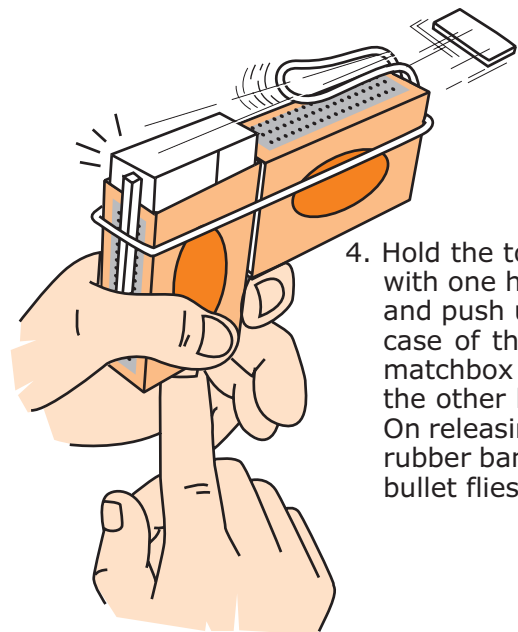
1. You need two empty matchboxes, two rubber bands, a used matchstick, a piece of cardboard and glue.



2. Fix two matchboxes with the rubber band as shown.

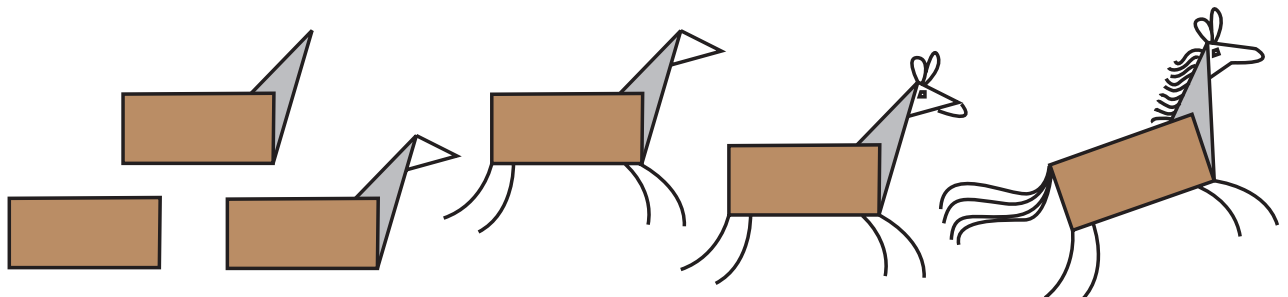


3. Pull the free rubber band backwards over the matchboxes and fix the loose end on the tip of the matchstick. Place a tiny rolled piece of card paper near matchstick.



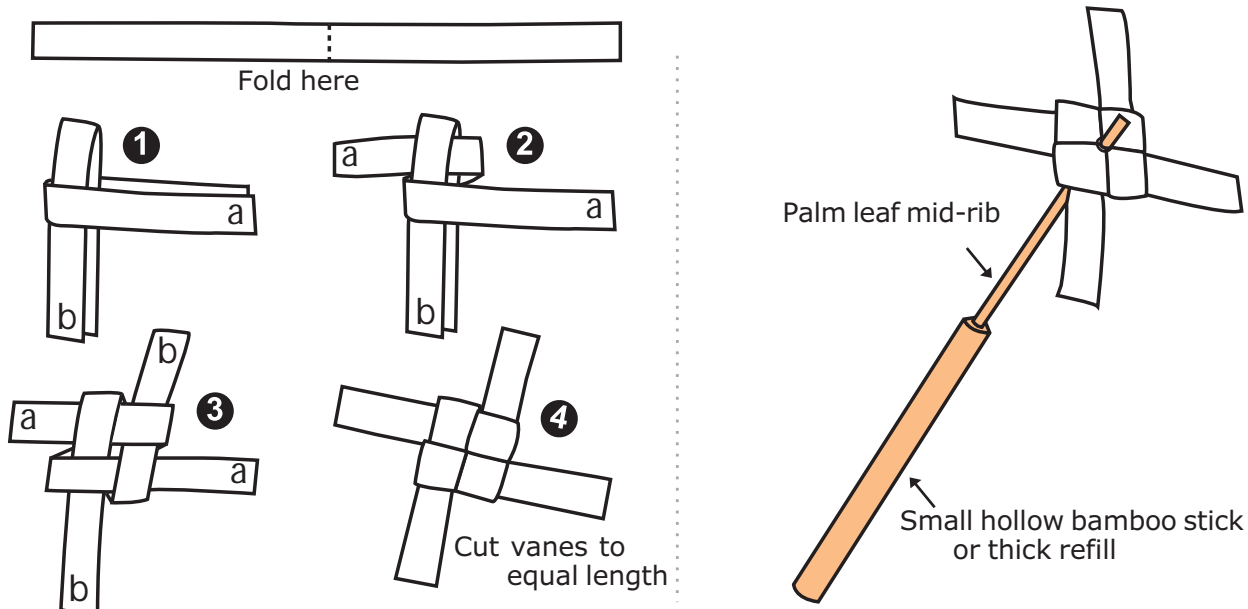
4. Hold the toy with one hand and push up the case of the matchbox with the other hand. On releasing the rubber band the bullet flies off.

## EASY TO DRAW

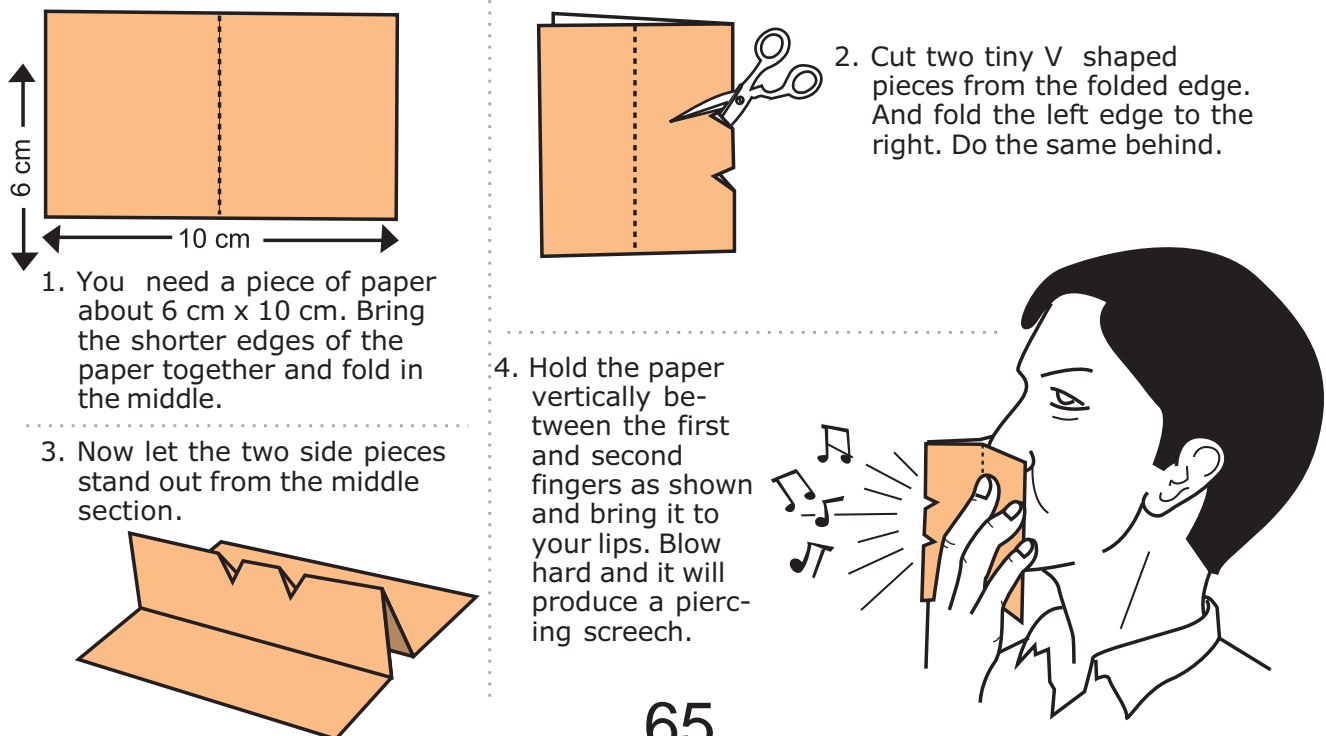


# WIND MILL

Take two strips of palm leaf each about 20 cm long and 2 cm wide. Follow the steps to complete the windmill.



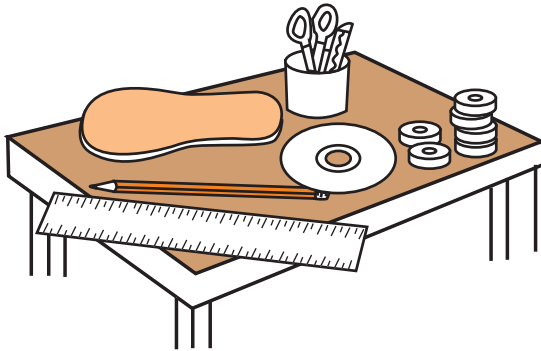
# SCREECHER



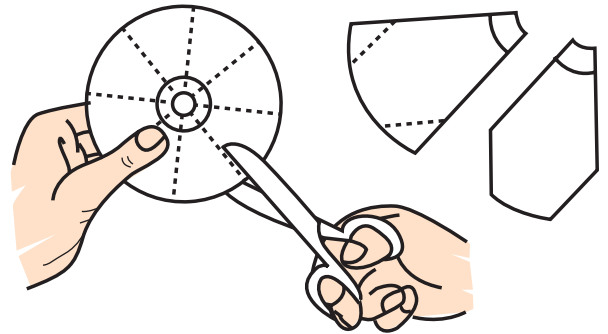


# IT LEVITATES, IT SPINS, IT WRITES!

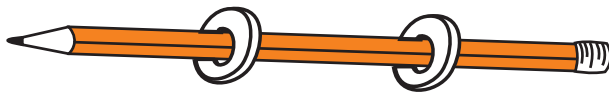
This is simply a terrific toy. You can while away hours playing with it.  
It also gives you a tremendous feel of what magnetic levitation is all about.  
It costs less than ten rupees.



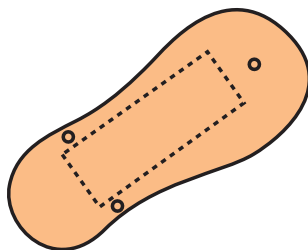
1. You need an old rubber slipper, discarded CD, 6 ring magnets (17.5 mm OD, 7.5 mm ID, 3 mm thick - they cost 1 rupee each), one pencil and few simple hand tools.



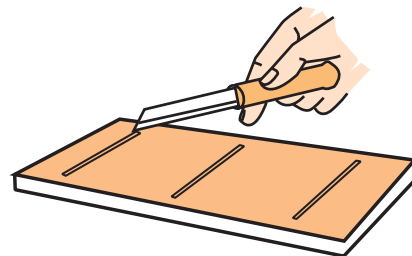
- 2 & 3 First mark out 8 equal sectors in the discarded CD. Cut one sector using a big scissors. Cut the lower corners at an angle.



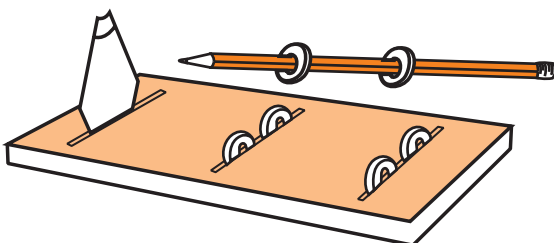
4. Take two ring magnets and press fit them in a pencil. They are just right to fit into a pencil. You might have to scrape the pencil a bit. The polarities of the magnets do not matter.



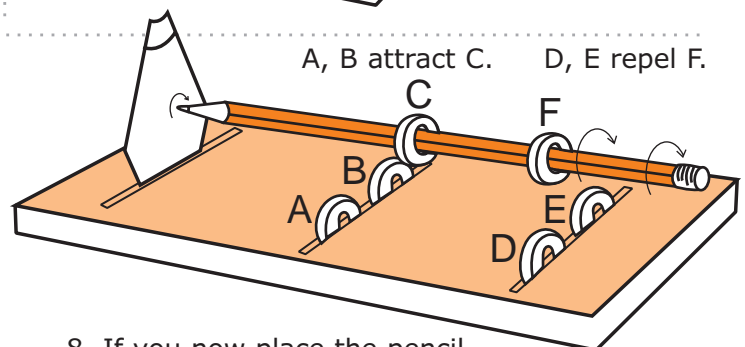
5. Cut a rectangle 15 cm x 7.5 cm from an old rubber slipper.



6. From one end mark out lines at 2 cm, 6.5 cm and 12.5 cm. Make 5 cm wide cuts on these lines.



7. Now insert the CD piece. Place 2 ring magnets in the rubber slit next to the CD. These magnets must have poles which attract the pencil magnet close to the writing end. Insert two more ring magnets in the other slits. These magnets must repel the pencil magnet (away from the writing end).

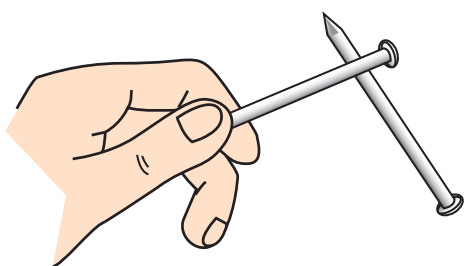


8. If you now place the pencil it will levitate in air with its tip resting on the CD. Now twirl the rear end of the pencil and it will keep spinning for a long time. You may have to adjust the positions of the pencil magnets a bit to get the pencil to levitate.

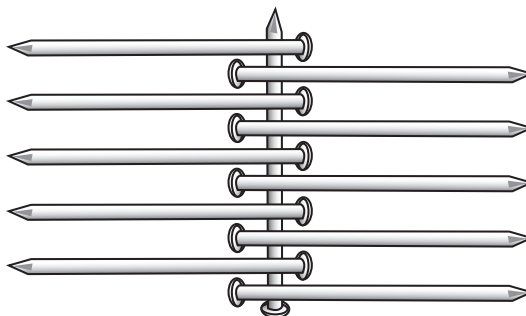


# BALANCING NAILS

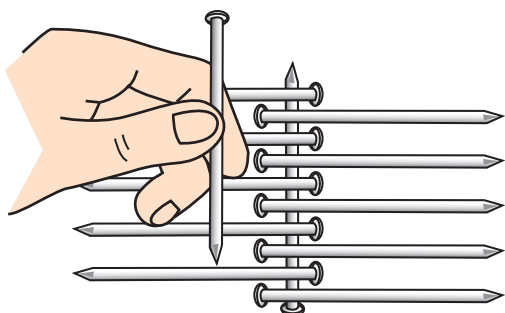
Can you balance a dozen nails on the head of one nail!  
Sounds impossible! But it can be very easily done.



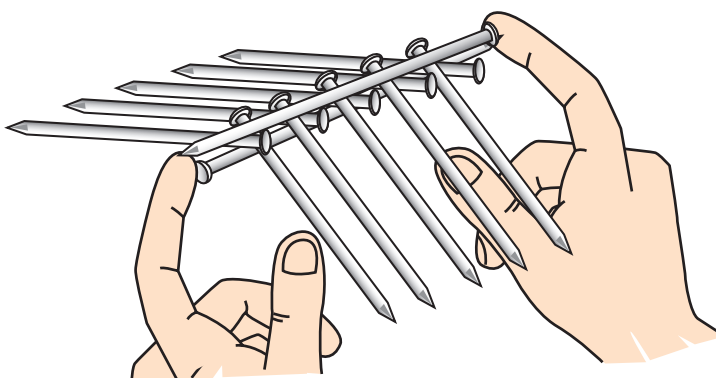
1. Get a dozen 10 cm long nails. Arrange them...



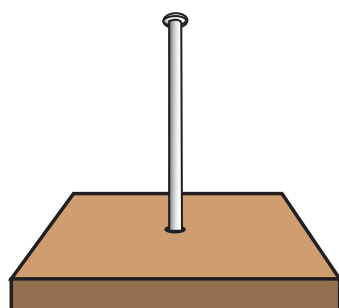
2. ...in the order shown in the picture. Five nails have heads to the right: the other five have heads to the left. This takes care of 11 nails.



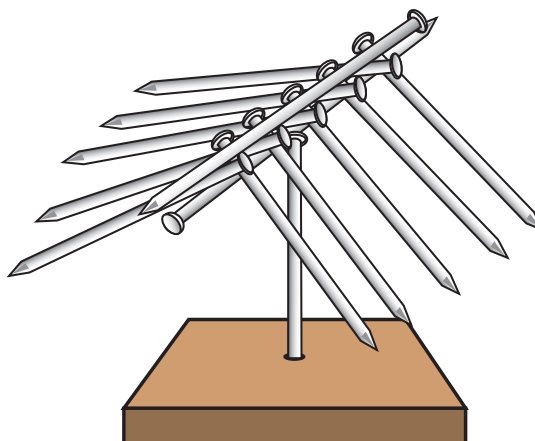
3. The last nail is put exactly in line with the first nail. It rests between the heads of all the nails.



4. Now, grip the ends of the two vertical nails and lift up the entire assembly. You will be surprised to see that the nails jut out like roof poles without falling.



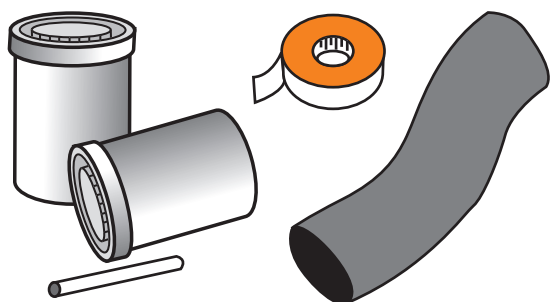
5. On a wooden block hammer a 12 cm long nail.



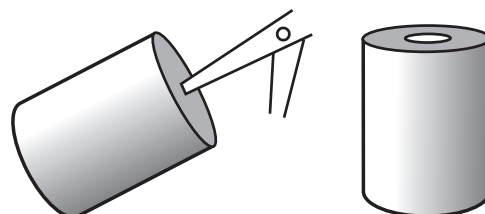
6. Gently place the assembly on the head of this nail. You will be surprised to see the entire assembly of a dozen nails neatly rests on the head of one single nail! The assembly is quite stable and you can rock the nails sideways like a swing.

# BALLOON PUMP

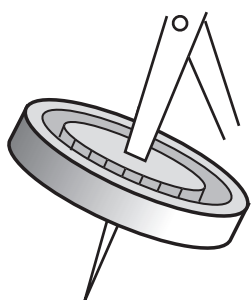
With this simple pump you can actually inflate a balloon and make it POP!



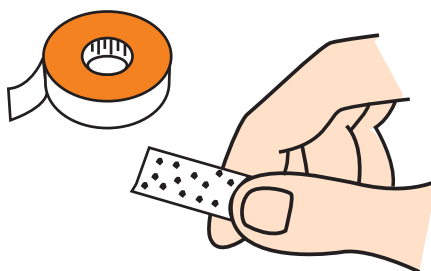
1. You will need two film-reel bottles, 15 cm of old cycle tube, old refill or a stiff straw, and cello-tape.



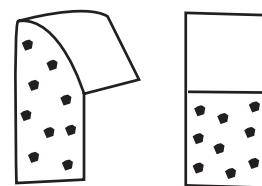
2. Make a hole in the base of film-reel bottle A by using a divider point. Widen this hole by gently rotating the pointed end of a scissors. The hole should be about 1 cm in diameter and should not have any burrs.



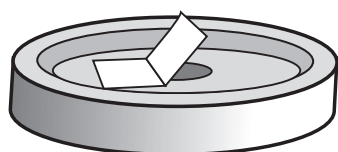
3. Make a similar hole in another cap.



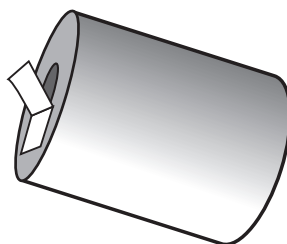
4. Take 3 cm of sticky tape. The dots show the 'sticky' side.



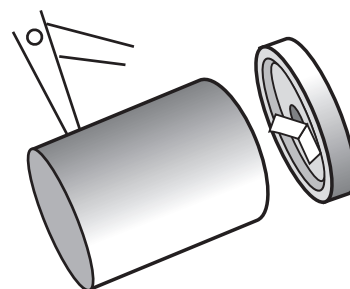
5. Fold 1 cm of the sticky part on itself. The lower 1 cm would still be sticky. Prepare two such tapes.



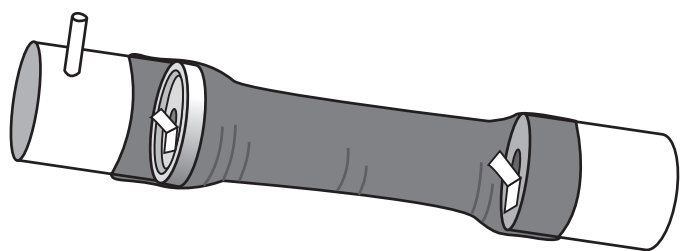
6. Stick the glue part of one tape to the cap. The tape will act like a hinge. It will open and close like a valve. This will be the DELIVERY VALVE.



7. Paste the other tape on the base of the film-reel bottle A. This will be the SUCTION VALVE.

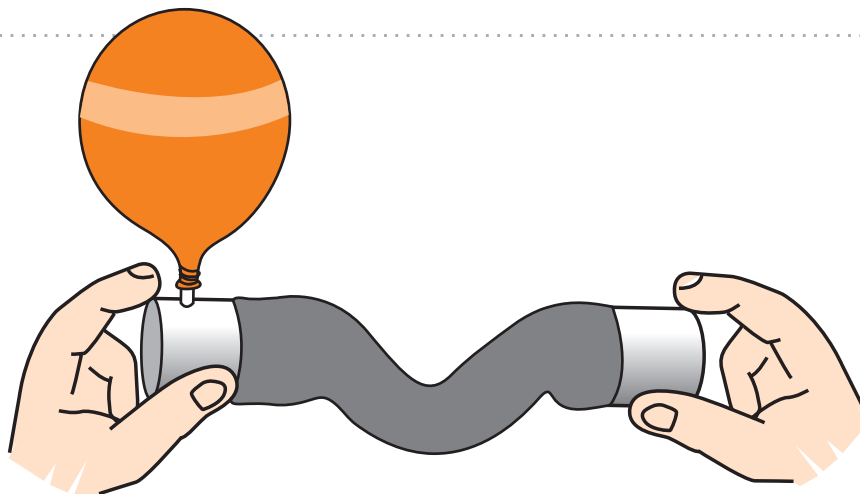


8. Take another film-reel bottle and make a small hole on its cylindrical surface. Press fit a short stiff straw in it for the delivery pipe. Fix the cap with the delivery valve to the other bottle.

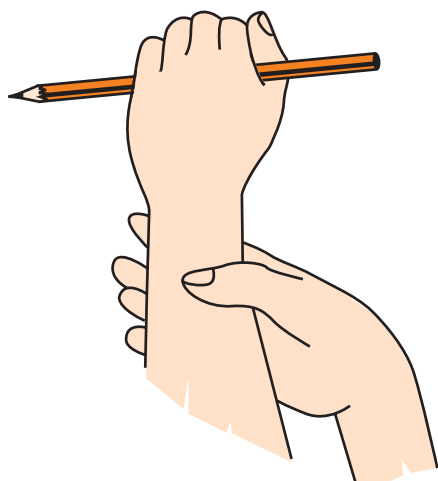


9. Cut a 22 cm long piece from an old bicycle tube. Stretch and slide the tube over both the bottles. Bottle B will go lid down, while bottle A will go bottom-up in the cycle tube. The bottles will be separated by 15 cm of cycle tube. This rubber tube acts like a pair of bellows.

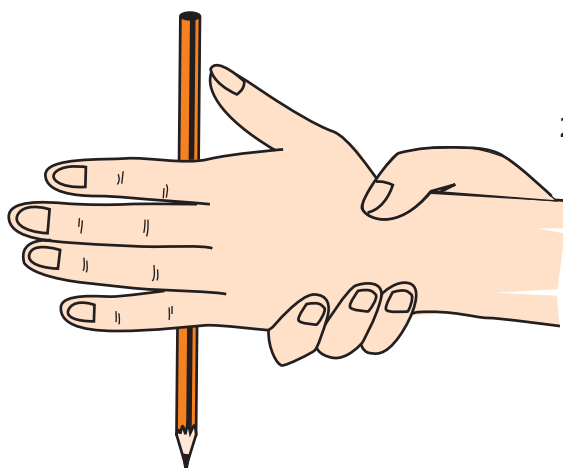
10. Now hold a medium size balloon in the delivery pipe. Fix it to the pipe with a rubber band to prevent any air leak. On repeatedly pumping the cycle tube by holding the two bottles, the balloon will inflate. You can "POP" a balloon with this simple pump.



## MAGNETIC HAND

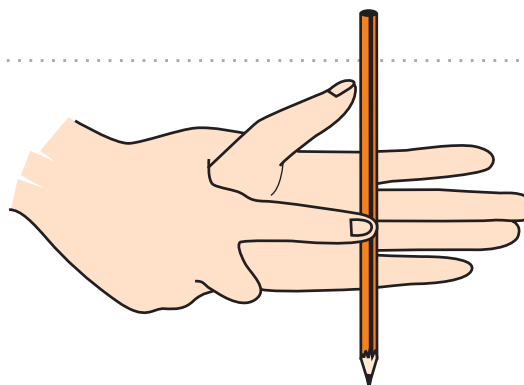


1. Hold a pencil in your left hand, the back of which should be towards the audience. Rub the inside of your left wrist with the other hand, explaining that this is to create "magnetic force".



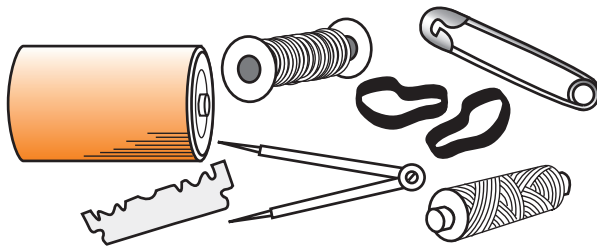
2. Suddenly open your fingers - and the pencil appears to be suspended without support.

3. Actually you hold the pencil with the tip of your right forefinger, which your audience cannot see.

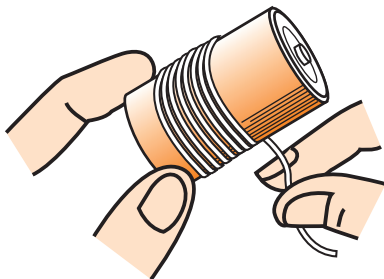


# A REVOLUTIONARY MOTOR

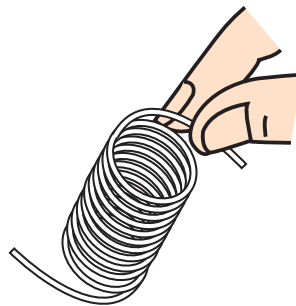
A rotating electric motor is amazing fun. And this is, by far the simplest electric motor on earth!



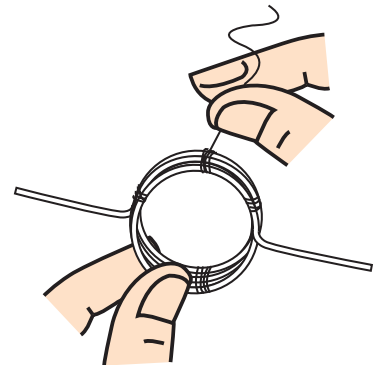
1. You will need a new, 1.5 volt normal torch battery, 1 metre of insulated Copper wire (about 20 gauge) used for motor rewinding, one magnet (one from an old radio speaker will be ideal), two big safety pins, two rubber bands 1 cm wide cut from an old bicycle tube, some thread and ordinary hand tools.



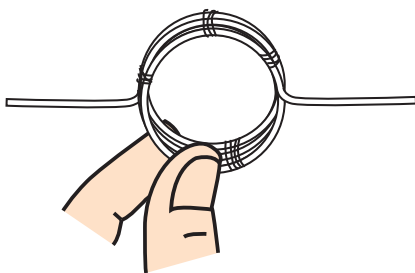
2. Take 1 metre of Copper wire (20 gauge). Straighten it by running it through a piece of cloth. Wind it tightly on a torch battery. The loops of the wire should be adjacent to one another. They should not overlap. The coil should have about 10 turns.



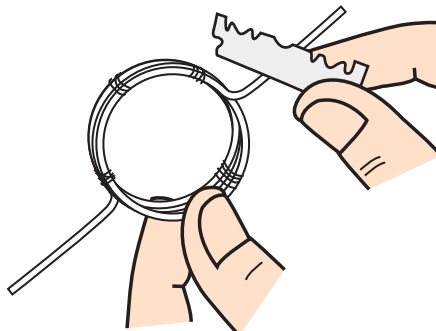
3. When the coil is removed from the battery it opens up like a spring.



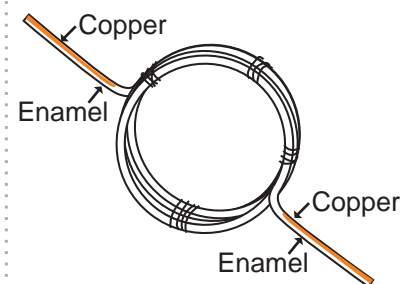
4. Tie the coil at several places with little bits of string. The string will keep the loops of the coil in place.



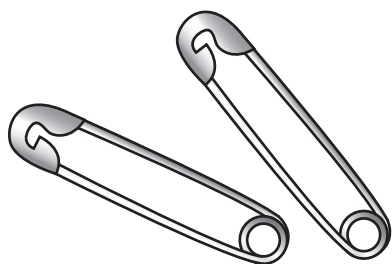
5. The two ends of the coil should jut diametrically outwards. The coil will rotate on these two ends. So, ensure symmetry and even distribution of the coil's weight.



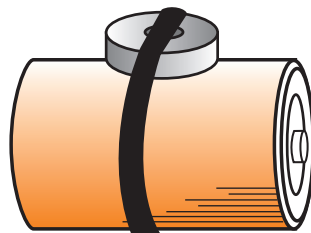
6. Now, scrape the enamel from three sides of the end leads using a blade. The enamel will remain only on the BOTTOM of the end leads.



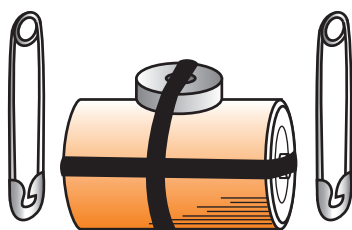
7. The copper / enamel sequence leads to make / break of the circuit. This BRUSH or COMMUTATOR is the heart of this simple motor. If all the enamel is removed from the end leads then the motor will not work. The coil is now ready.



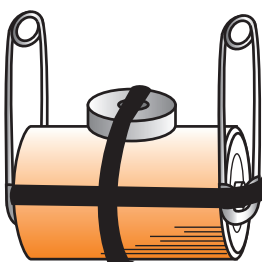
8. Take two long safety pins.



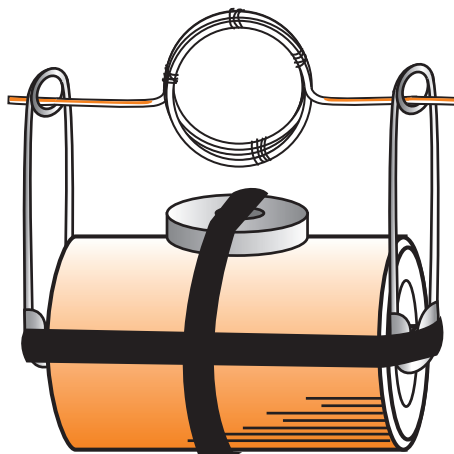
9. Salvage an old radio speaker magnet (standard laboratory magnets will do well) and place it on a new battery with the help of a cycle tube rubber band.



10. Stretch out another cycle tube rubber band (1 cm wide) along the length of the battery. Now insert the safety pins in the rubber band.

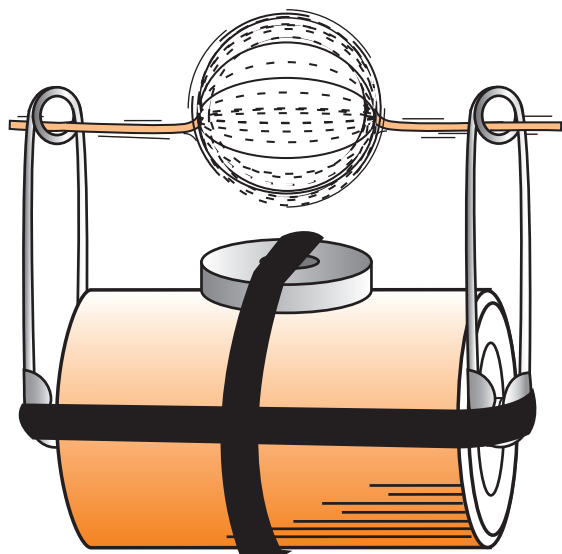


11. The safety pins serve three purposes. They act as power leads, supplying current to the coil. They are also bearing supports for the coil. Finally, they also make a stand for the motor.



12. Now pull the pins a little apart and slip the motor coil in their holes.

13. Give the coil a gentle starting push and it will start rotating. However, if the push is in the wrong direction, then the coil will stop after a while, flip, and rotate in the right direction.



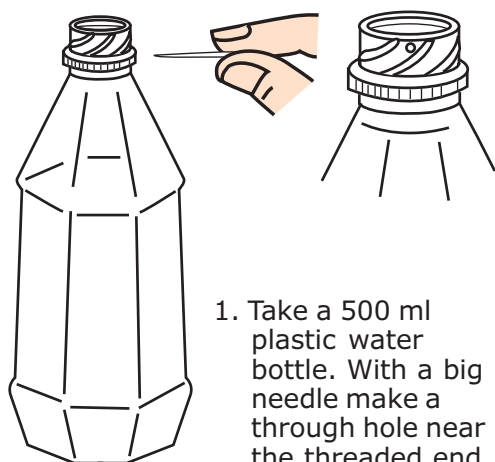
#### How does the motor work?

When an electric current flows through a wire, it produces a magnetic field around it. Similarly, when current flows through the motor coil, then the coil becomes an electro-magnet with two poles - a North and a South pole.

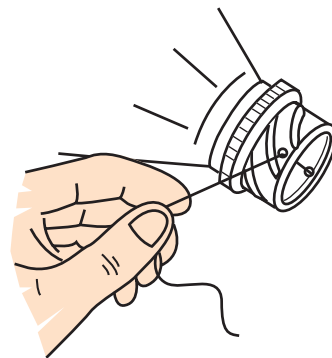
According to the Law of Magnetism - like poles repel and unlike poles attract. Following this law the North pole of the electro-magnet is attracted to the South pole of the permanent magnet and is repulsed by its North pole. This mutual attraction - repulsion makes the motor coil turn. The coil will stop once its N and S poles align with the S and N poles of the permanent magnet. But just when this point reaches, something happens. Until now, the copper part of the coil ends were in contact with the metal strips. But now, the enamel part of the coil end comes in contact, and being an insulator, it switches off the current to the coil. The coil is no more a magnet, it becomes demagnetised. Momentum propels the coil on until once again the copper on its leads touches the metal strips. Once again the coil becomes an electromagnet. In this way the coil continues to revolve, round and round.

# SPINNING BOTTLE

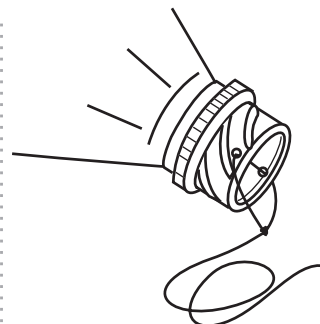
This simple experiment demonstrates Newton's third law of motion - that every action has an equal and opposite reaction.



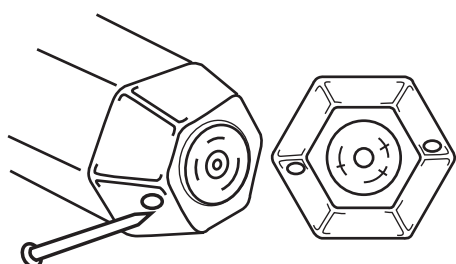
1. Take a 500 ml plastic water bottle. With a big needle make a through hole near the threaded end.



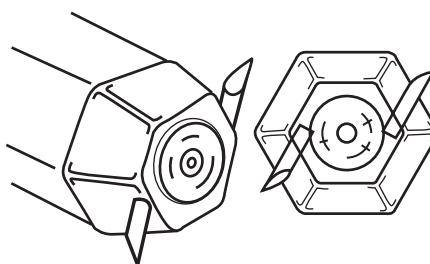
2. Weave a 8 cm thread through this hole and tie a knot to make it a loop.



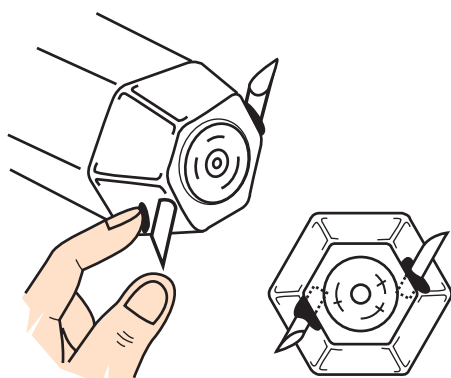
3. Tie a long thread to this loop.



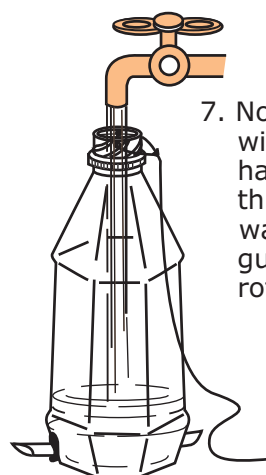
4. With a big nail make a hole on the vertical wall of the bottle near its base. Make another hole at the other end.



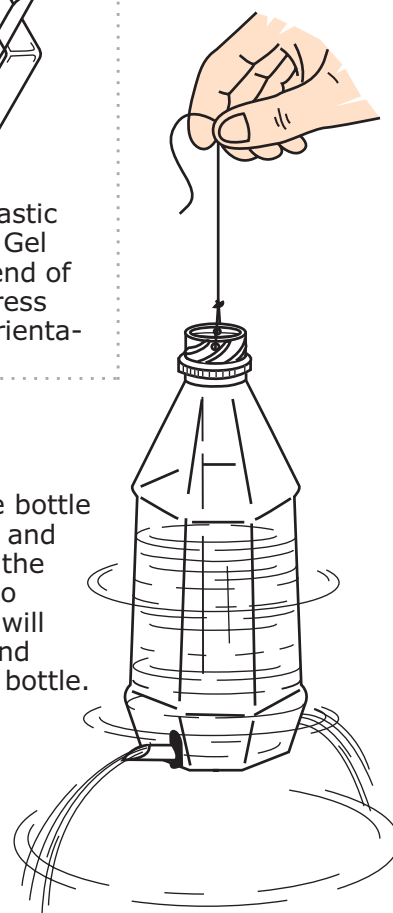
5. Take two pieces of stiff plastic straw 3 cms long (old Add Gel refills are ideal). Cut one end of these pieces at a slant. Press them in the holes in the orientation shown.



6. Apply M-seal or some other adhesive (kneaded wheat flour does well) to prevent leakage.



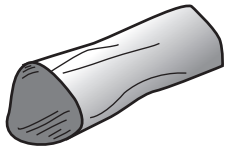
7. Now fill the bottle with water and hang it by the thread. Two water jets will gush out and rotate the bottle.



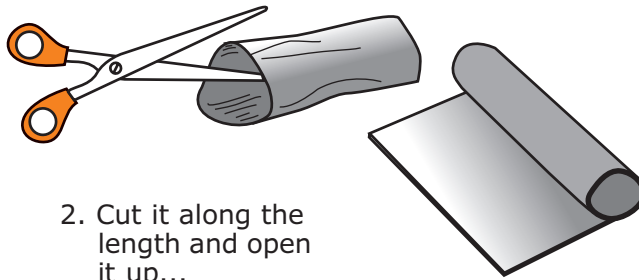


# RUBBER STAMPS

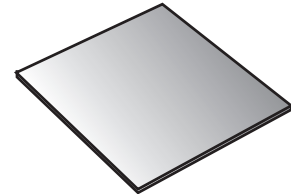
Simple rubber stamps can be made using pieces of old cycle tube, blocks of wood and glue. Children can make lovely collages using these zero-cost rubber stamps.



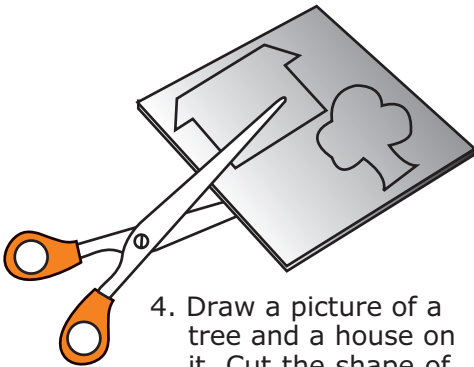
1. Take a piece of old cycle tube.



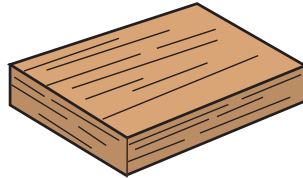
2. Cut it along the length and open it up...



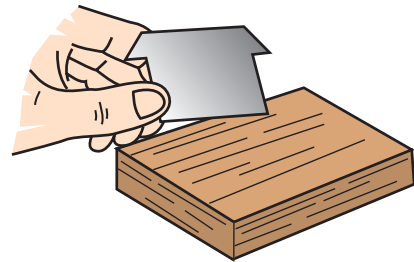
3. ....to make a flat rubber sheet.



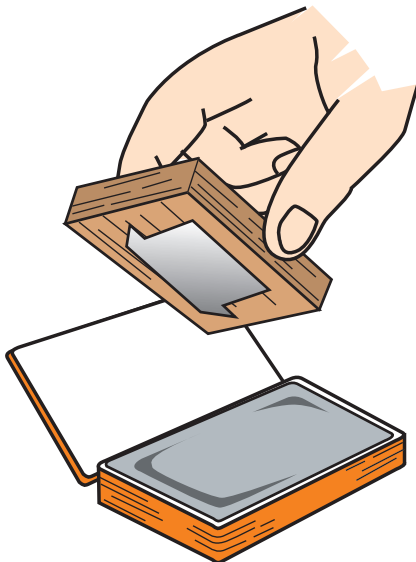
4. Draw a picture of a tree and a house on it. Cut the shape of the house and tree.



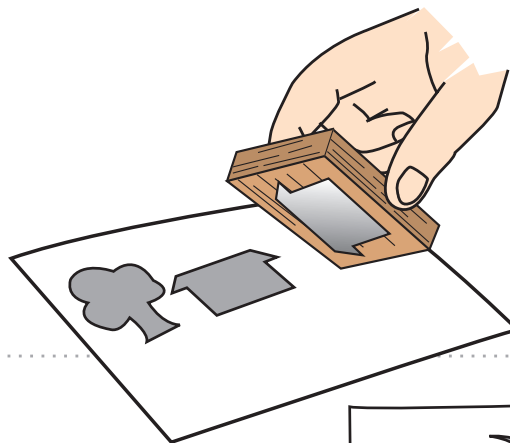
5. Take a block of flat wood.



6. Stick the rubber house cutout on the block using rubber adhesive (Cycle puncture solution or Fevibond).

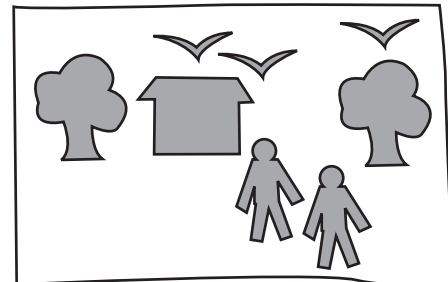


7. Press the rubber stamp on the ink pad.



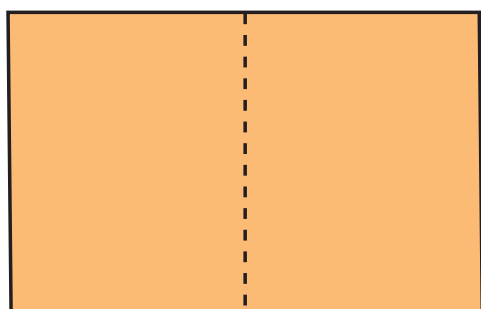
8. Print these shapes on a sheet of paper.

9. Children can make lovely pictures using these zero-cost rubber stamps.

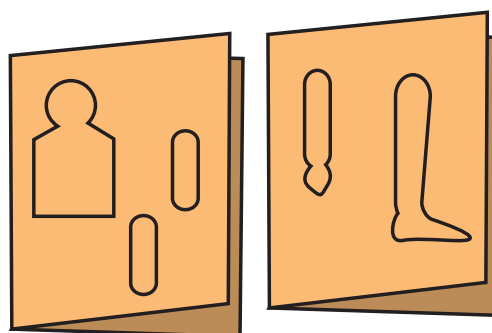


# ACROBAT

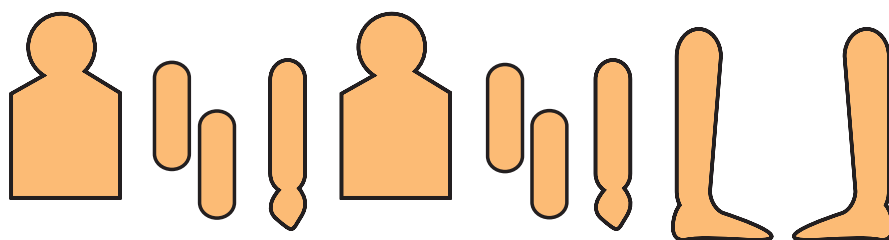
A very simple and dynamic model. When the toy is spun the arms and legs of the acrobat fly in the air - demonstrating centrifugal force.



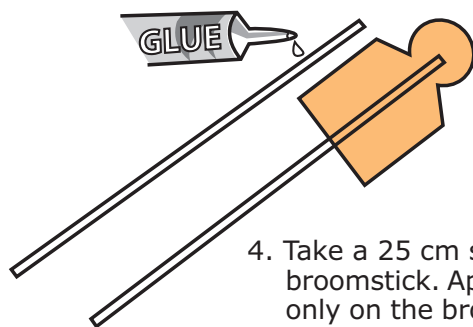
1. Take a thick card sheet 30 cm x 15 cm. Fold it in half.



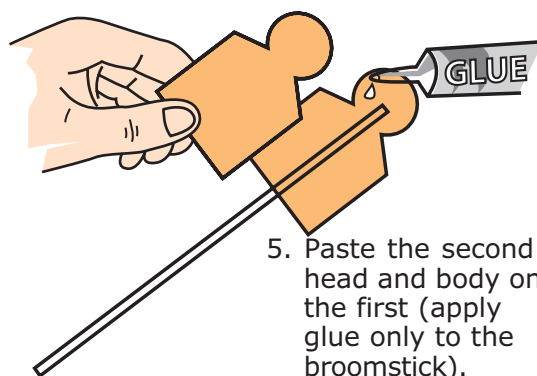
2. Draw a head and body, two fore-arms, one arm and leg as shown.



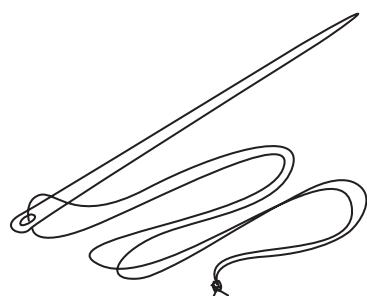
3. After cutting these there will be 10 pieces as shown in the picture.



4. Take a 25 cm strong broomstick. Apply glue only on the broomstick. Stick it in the middle of one head and body.

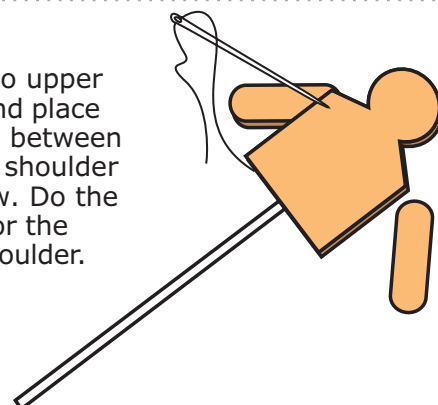


5. Paste the second head and body on the first (apply glue only to the broomstick).

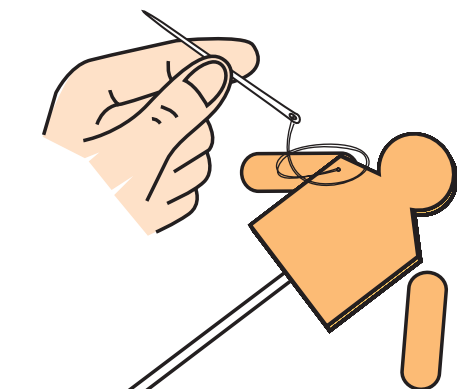


6. Weave a doubled thread through a long needle and tie a knot.

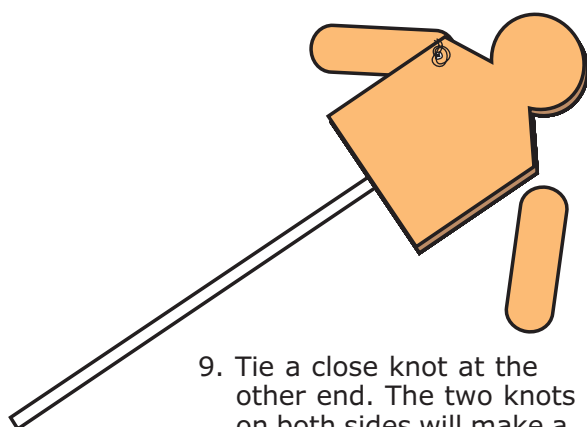
7. Take two upper arms and place them in between the left shoulder and sew. Do the same for the right shoulder.



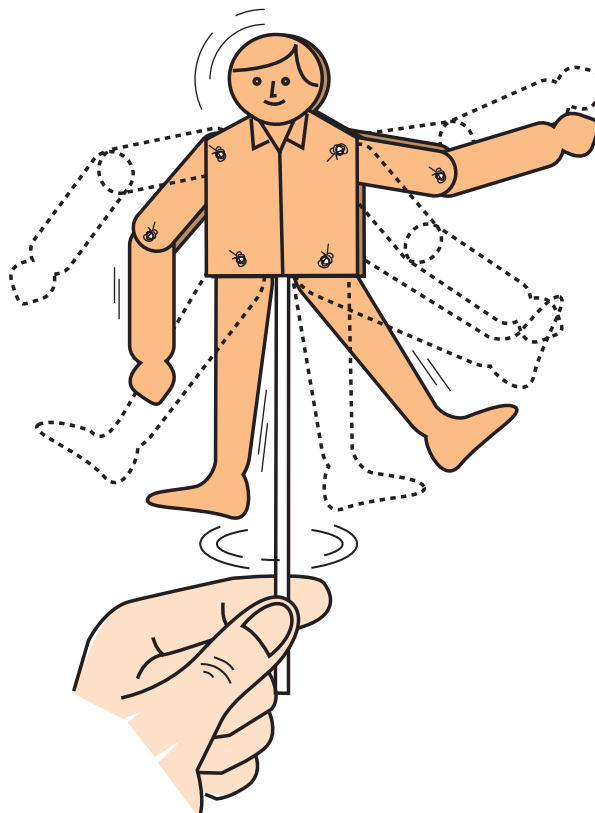




8. Pass the needle through. There would be one knot at one end.



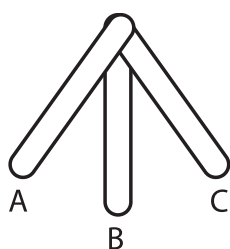
9. Tie a close knot at the other end. The two knots on both sides will make a nice movable hinge.



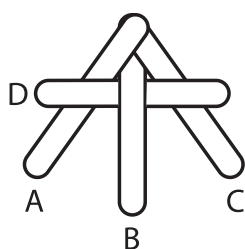
10. Similarly, attach the forearms and legs (one piece each), with thread hinges. The acrobat will now be ready to perform. Hold the broomstick between the thumb and index finger. Twirl the broomstick. The acrobat will wildly swing its arms and legs.

## ICE-CREAM STICK BOMB

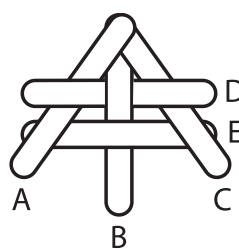
You just require five used ice-cream sticks for making this gentle bomb.



1. Hold three ice-cream sticks, A, B and C together at one end with B on the bottom, spread as shown in the diagram.



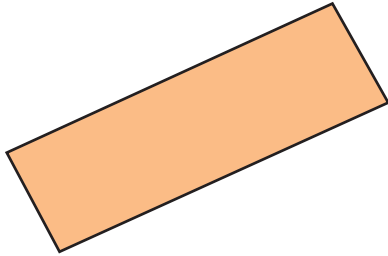
2. Insert a fourth stick D, over A, under B and over C as shown.



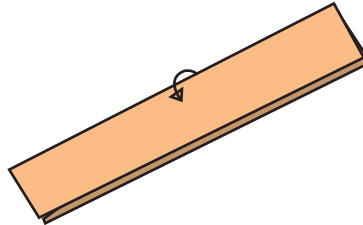
3. Insert the last stick, E under A, over B, and under C as shown. The assembly of 5 ice-cream sticks will hold itself together. Try throwing it up in the air or against a wall. When it lands, it will "explode" and the sticks will fly in all directions.

# PAPER CLAPPER

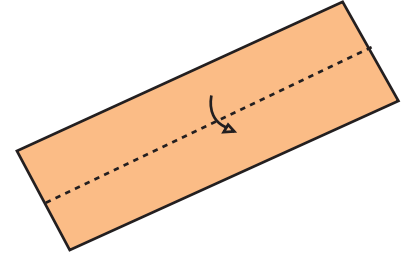
I first saw this paper clapper with Dr. Anil Awchat of Pune.  
It is simple to make and great fun to play with.



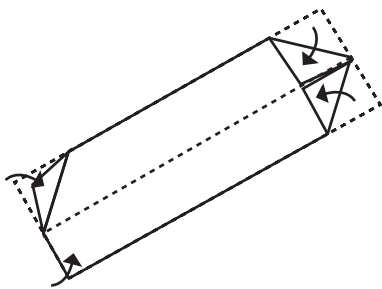
1. Take an old A-4 size Xerox paper and cut it in half along the length.



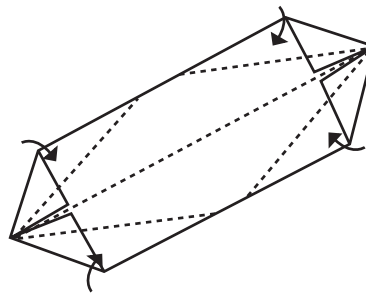
2. Fold it in half.



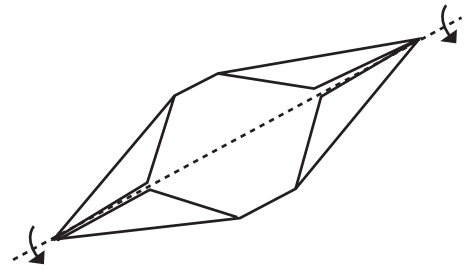
3. And open it again.



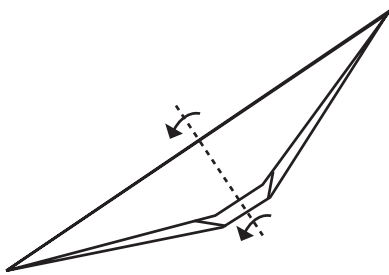
4. Fold all the four corners as shown.



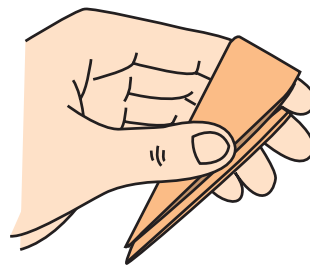
5. Once again fold inwards along the 4 slanting dotted lines.



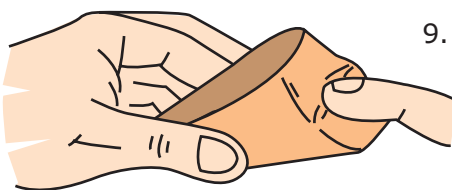
6. To arrive at this shape. Fold this shape in half.



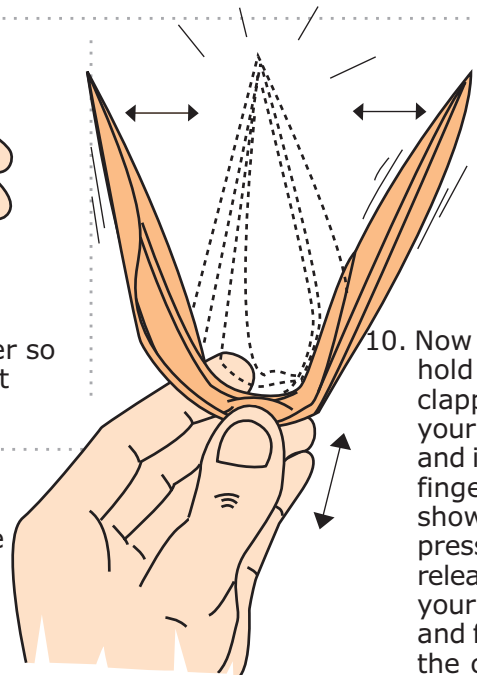
7. Again fold along the dotted line in half.



8. Fold it on your finger so that the fold is a bit rounded.



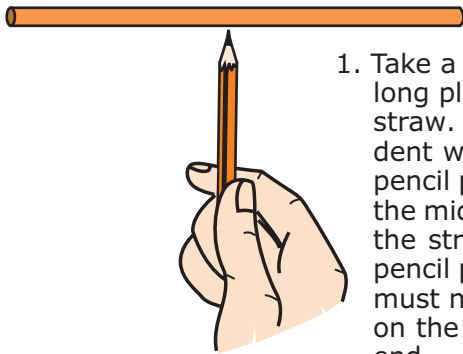
9. Make a crease at right angles on the rounded fold. This crease will act like a spring.



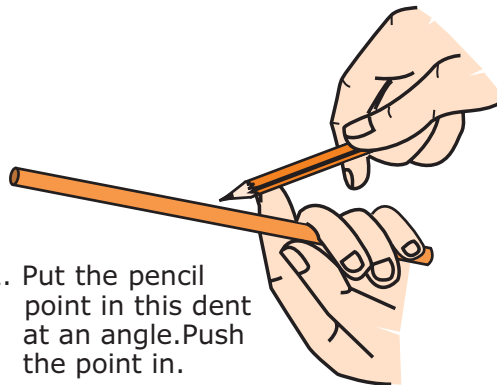
10. Now hold the clapper with your thumb and index finger as shown. On pressing and releasing your thumb and finger the clapper hands will clap.

# ROTATING LOOP OF THREAD

This toy was found to be very useful with children suffering from asthma. Children have fun blowing at it. They simultaneously exercise their lungs.

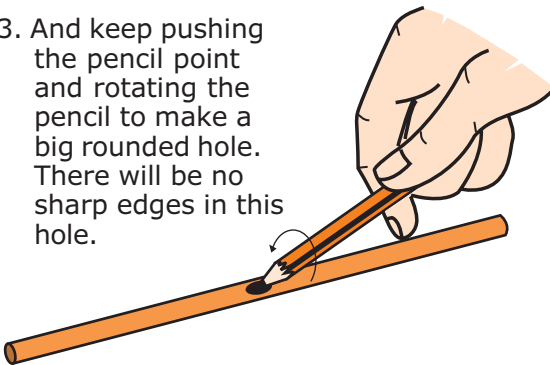


1. Take a 15 cm long plastic straw. Make a dent with a pencil point in the middle of the straw. The pencil point must not show on the other end.

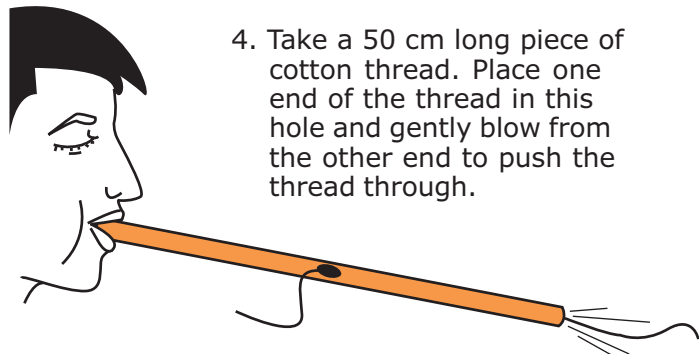


2. Put the pencil point in this dent at an angle. Push the point in.

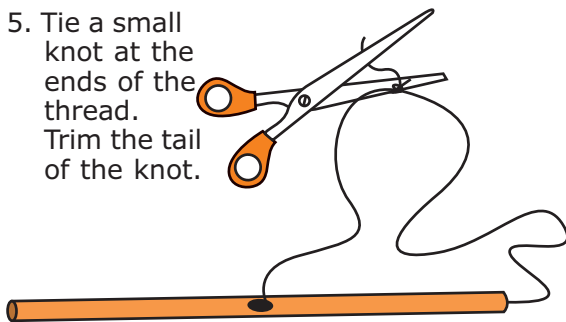
3. And keep pushing the pencil point and rotating the pencil to make a big rounded hole. There will be no sharp edges in this hole.



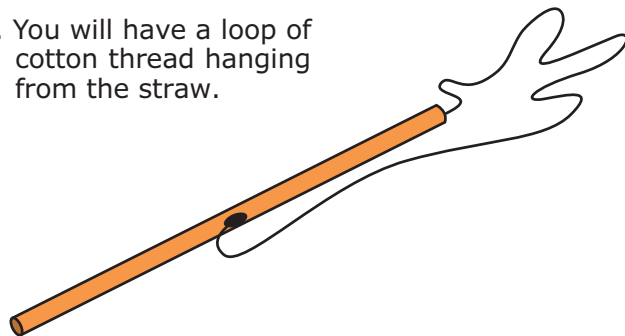
4. Take a 50 cm long piece of cotton thread. Place one end of the thread in this hole and gently blow from the other end to push the thread through.



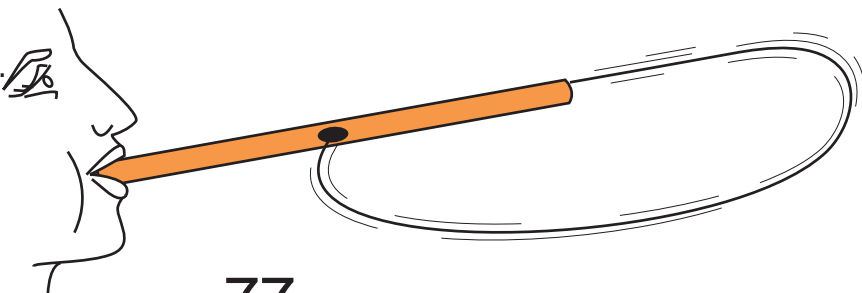
5. Tie a small knot at the ends of the thread. Trim the tail of the knot.



6. You will have a loop of cotton thread hanging from the straw.

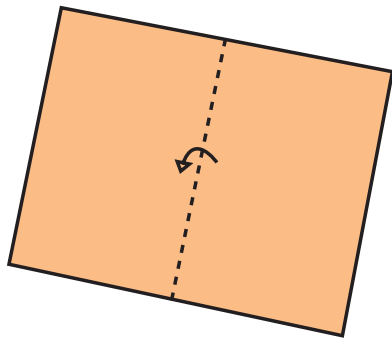


7. On blowing the whole loop of thread will rotate. Every fiber in the thread will get a push and the whole loop of thread will go round-and-round. If the knot gets stuck in the hole then either make the knot small or make the hole bigger.

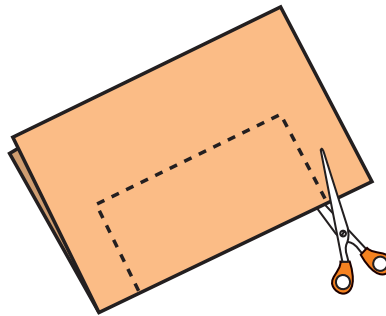


# MULTI STEP POP-UP

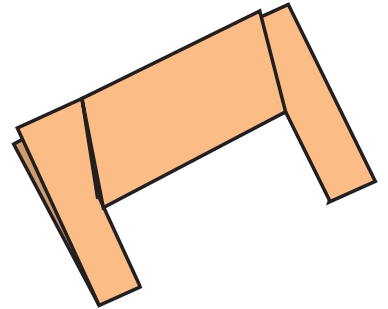
A pop-up, in a pop-up in a pop-up. This three-in-one pop-up makes a very pretty step ladder.



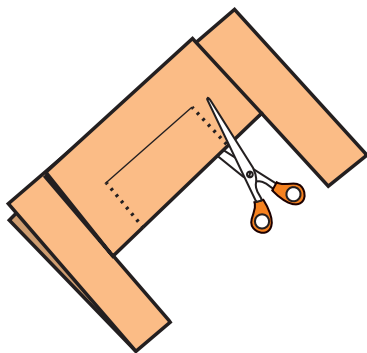
1. Fold a sheet of stiff paper into half.



2. Draw two lines perpendicular to the fold crease and join them. Cut along the dotted lines.

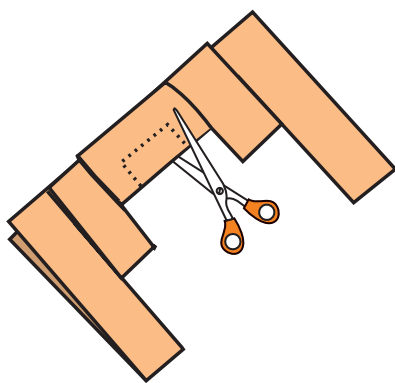
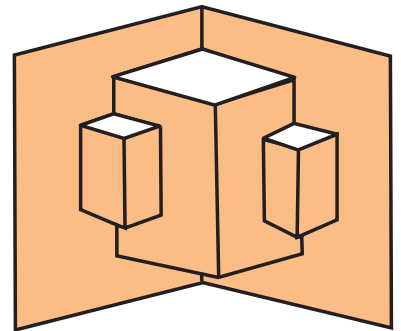


3. Fold a crease between the ends of the slits. Fold the paper forwards and backwards along the same line.

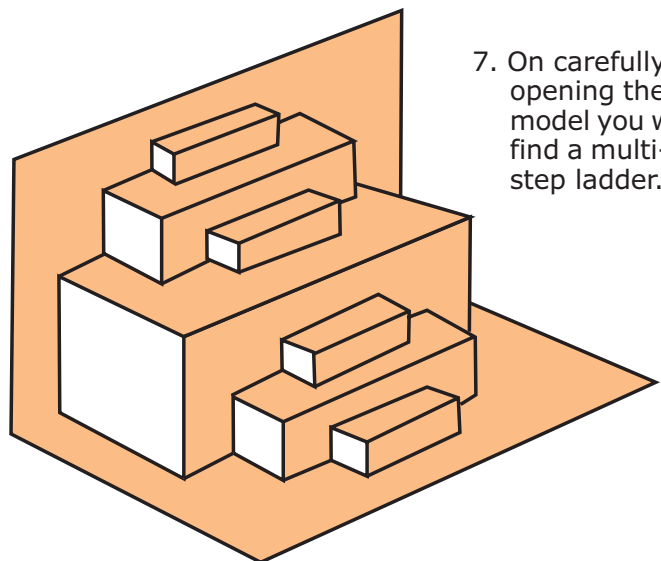


4. Finally close the pop-up and make two more slits. Fold a crease between the ends of the slits.

5. At this stage the pop-up will look like this.



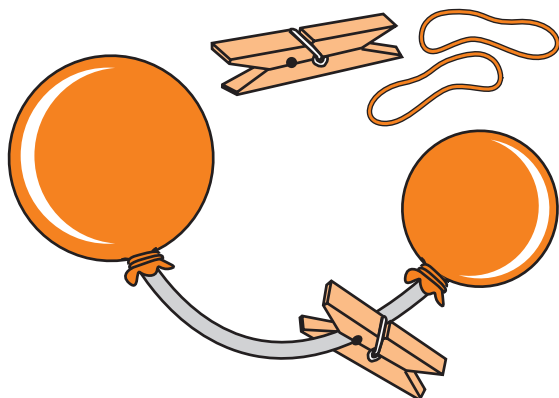
6. Again close the pop-up and make two more slits. Fold a crease between the ends of the slits.



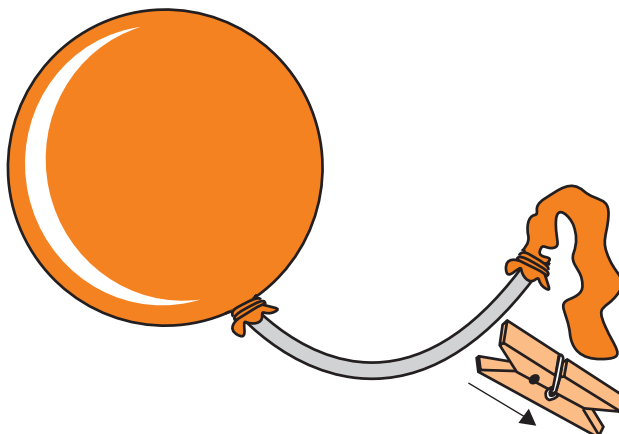
7. On carefully opening the model you will find a multi-step ladder.

# SMALL IS STRONG!

We often think big as strong. But sometimes it could be the other way round.

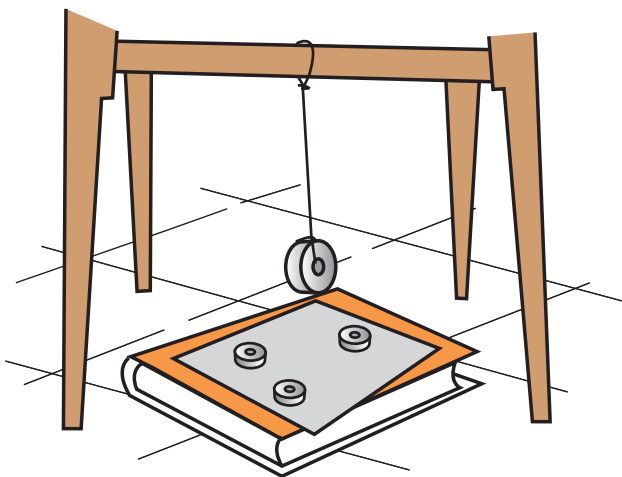


1. You will need two identical balloons, 10 cm length of plastic tubing and a clothespin. Fold the tube in half and pinch the halves together with the clothespin. Blow up one of the balloons so that it is almost fully inflated. Attach the neck to one end of the tubing with a rubber band (you may have to try a few times before you get an airtight connection). Inflate the second balloon slightly and attach it to other end of the tubing with the remaining rubber band. Open the clamp, allowing air to pass freely from one balloon to the other.



2. What do you expect would happen? Normally one would expect both the balloons to end up the same size. But something unexpected happens. The small balloon will always empty its contents into a large balloon. The explanation is as follows. Fluids in a flexible container assume a shape that has the smallest surface area. A single large sphere has less surface area than two small spheres whose contents equal the single large one. Since one large balloon has less surface area than two balloons containing the same amount of air, the small balloon empties its contents into the larger one.

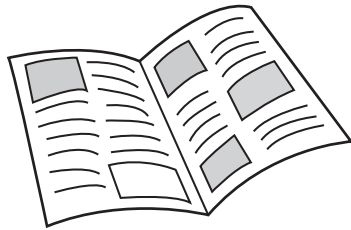
# CRAZY MAGNET



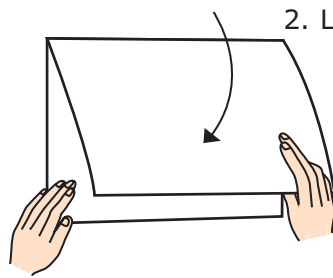
Hang a magnet from the cross bar of a chair using a 30 cm length of thread. Place a tin or steel sheet on the floor. Stick a few magnets on this sheet. Raise it by placing books below so that there is just a little gap between the hung magnet and the magnets on the sheet. Now swing the hanging magnet. It will be attracted by some and repelled by some of the base magnets. The result would be a crazy magnet - which follows a fuzzy logic and wanders as if it were drunk!

# THE CAPTAIN'S HAT STORY

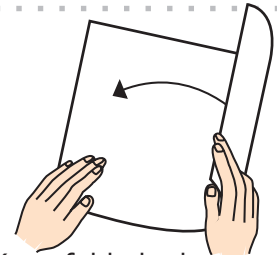
Lillian Oppenheimer told this delightful story to children for over 50 years. Lillian was the founder of the Origami Centre in New York. The Captain of the ship finds that all the passengers in his ship are getting seasick. So, everyday, he invites them all to the deck to sing and dance and make merry. The people wear their most colourful costumes and have great fun. The Captain has a big steel trunk in which he has different kinds of caps. He joins in the fun and wears a new cap everyday.



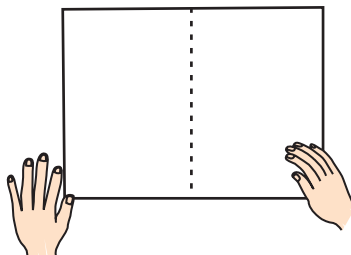
1. Take one full sheet of newspaper.



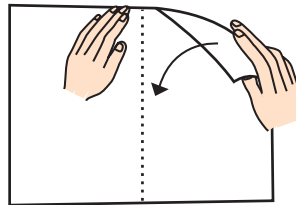
2. Leave the sheet of newspaper folded in half along the middle line.



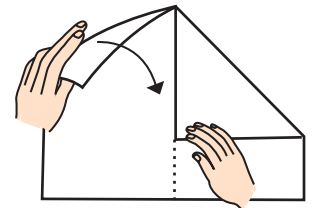
3. Keep folded edge on top. Now fold from right to left.



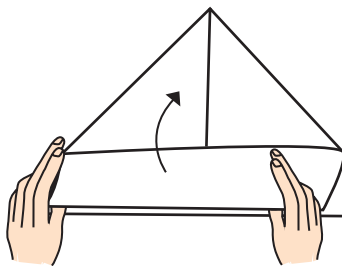
4. Unfold the paper.



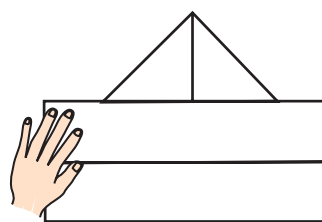
5. Fold down the top right - hand corner to meet the middle line.



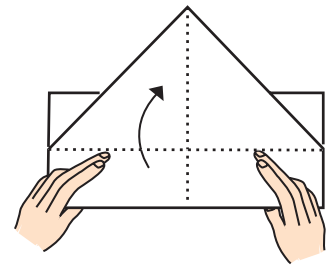
6. Fold down the top left - hand corner to meet the middle fold line.



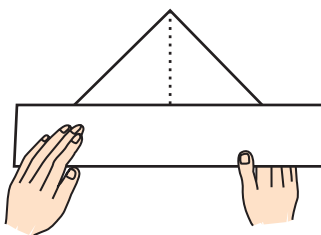
7. Fold up one single layer of paper, from the bottom up as far as it will go.



8. Press the paper flat. Turn it over from side to side.



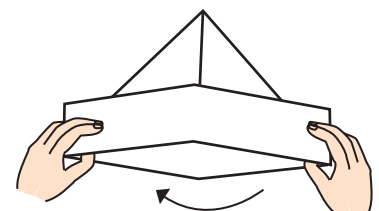
9. Fold up this single layer of paper as far as it will go.



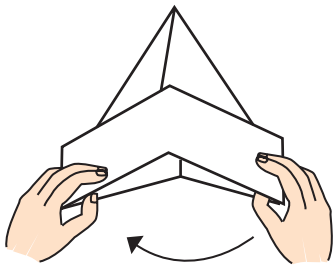
10. Press the paper flat. From the inside open out the paper a little.



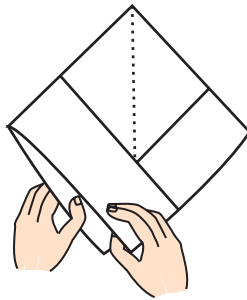
11. This is the captain's first cap - a SAILOR'S CAP.



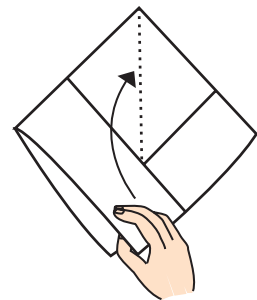
12. The captain used the same paper to make more caps.



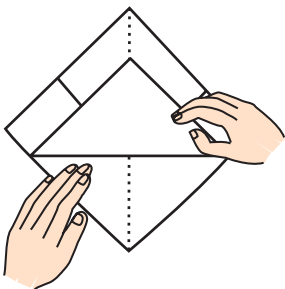
13. So, hold the cap and collapse it into...



14. ..this shape.



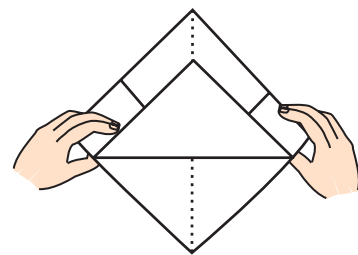
15. Fold up the top bottom point.



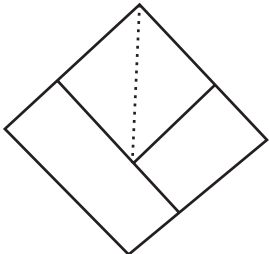
16. Press the paper flat so as to make...



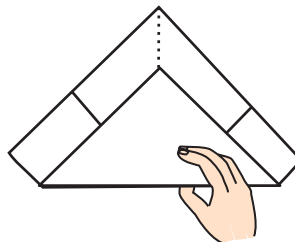
17. the FIRE MAN'S HAT.



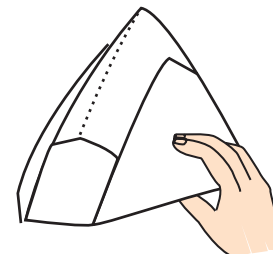
18. Press the paper flat and turn it from side to side.



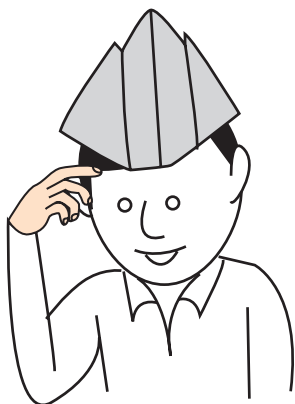
19. Fold up this bottom point.



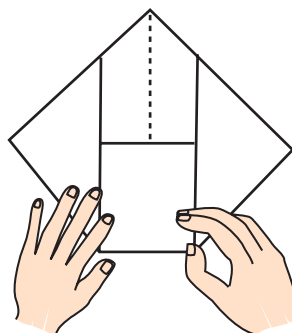
20. Hold the front and back of the hat. Carefully open out, and the hat will...



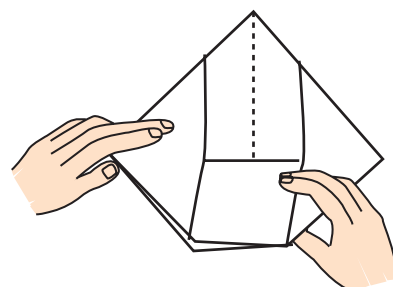
21. ...Again collapse to make...



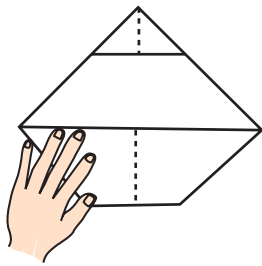
22...the SHIKARI CAP.



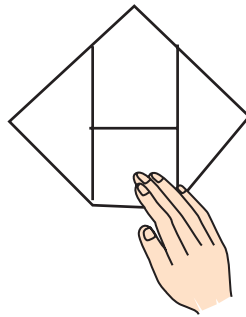
23. Press the paper flat



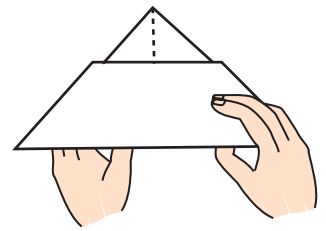
24. Fold the top layer from the bottom of the hat.



25. Press the paper flat and turn it over from side to side.



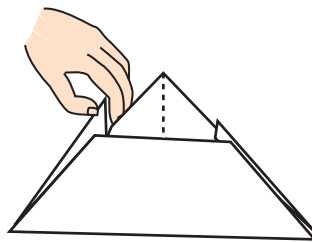
26. Fold up this bottom layer.



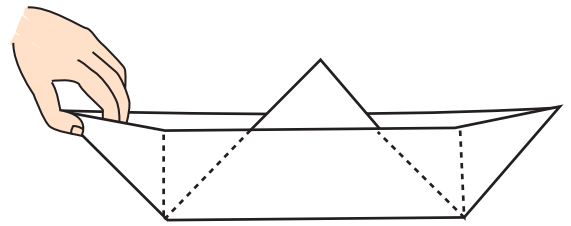
27. Open the paper out to make...



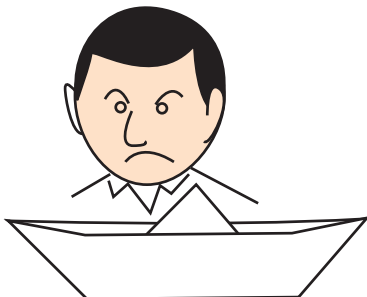
28.... An AIR FORCE OFFICER'S CAP.



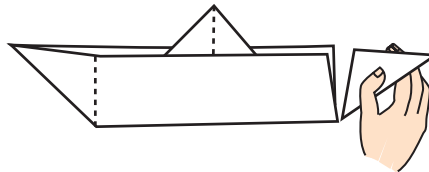
29. Well now, pinch the two side points...



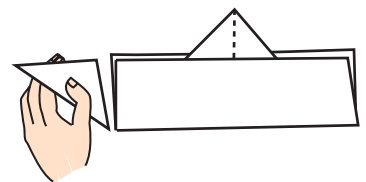
30. ...And pull them apart to make the traditional boat - the CAPTAIN'S SHIP.



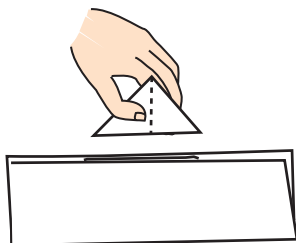
31. All of a sudden the ship gets caught in a fierce storm.



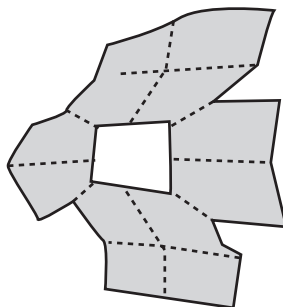
32. There is thunder and lightning. One huge wave knocks the stern (tear one corner).



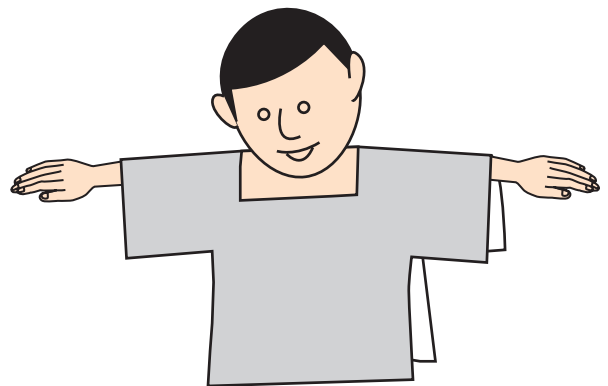
33. Another wave knocks off the bow (you tear the other corner off).



34. One last huge wave knocks off the bridge (you tear the triangle in the middle). The ship sinks.



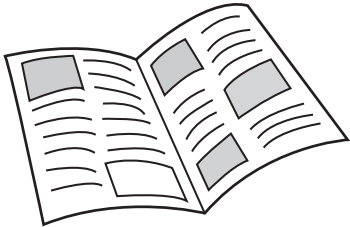
35. The captain loses all his hats. The captain has nothing left! (put your head in the hole).



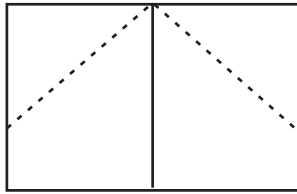
36. But a TORN SHIRT



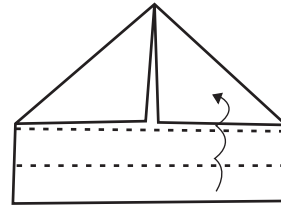
# RAJA CAP, NEHRU CAP, KULU CAP



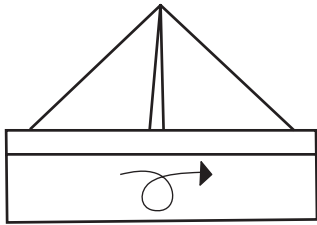
1. With a sheet of newspaper you can make three caps. Take a double spread newspaper sheet and fold it into half.



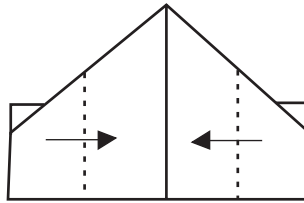
2. Keep the folded edge on top and fold the top left and right corners to the middle fold line.



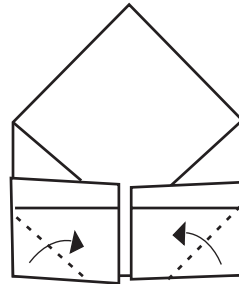
3. Fold up the top layer of paper from the bottom into half. Then double fold it.



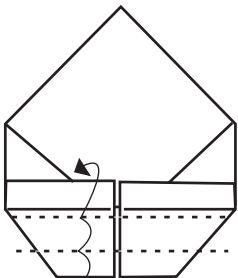
4. Now upturn the paper.



5. Bring the right and the left edges to the middle line and crease.



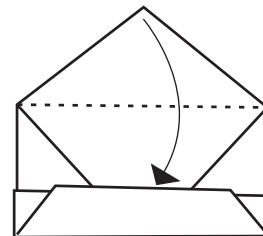
6. Hold the bottom right and left hand corners.



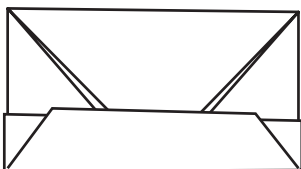
7. Fold the bottom portion into half and tuck the edge inside.



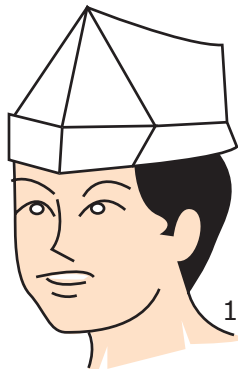
8. This cap looks like a KING'S CAP.



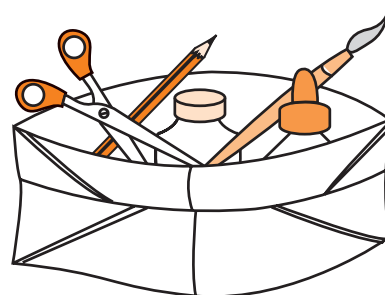
9. Now fold the top point of the King's cap to the midpoint on the base and tuck it in.



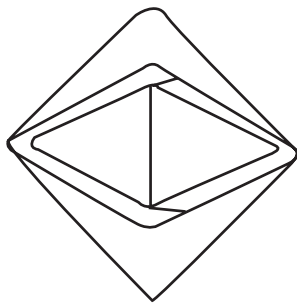
10. Open out the long edges and wear it like a ...



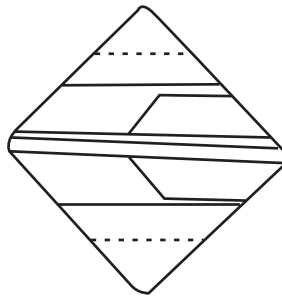
11. ...NEHRU CAP



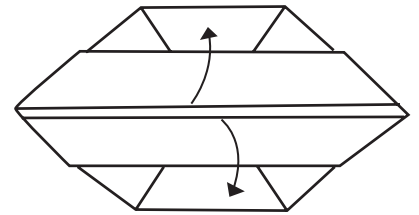
12. Invert the Nehru cap and use it as a very nice purse.



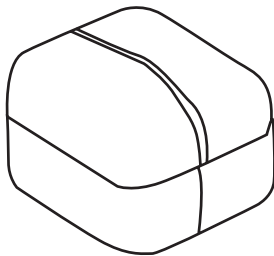
13. Slowly press the purse and squash to flatten it.



14. Fold top and bottom points along dotted lines and tuck them in the pocket.



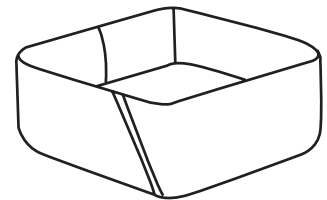
15. Open out the line in the middle to make a new cap.



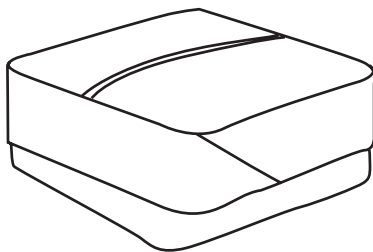
16. This is a BOX CAP or a KULU.



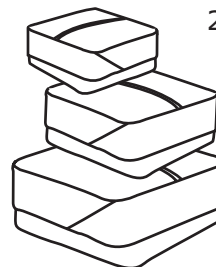
17. This famous cap is worn in Himachal Pradesh.



18. The corners of this cap can be straightened to form a square box. These boxes can be used for a variety of sorting out and storing activities.

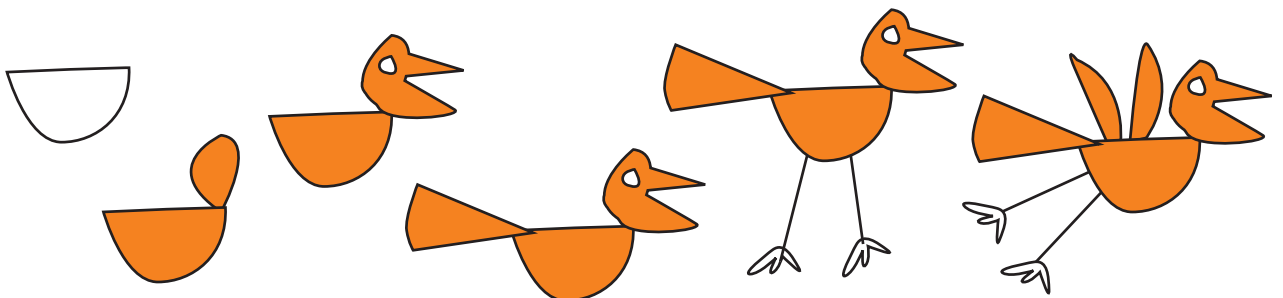


19. One box can be overturned as a lid on the other to make a closed gift box.

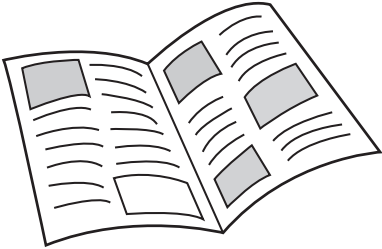


20. Using different sizes of newspapers you can make big and small boxes too. You can make a set of nesting boxes. Without any glue or scissors, you can fold these amazing boxes using ordinary newspapers.

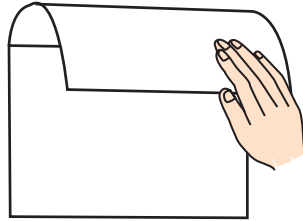
## EASY TO DRAW



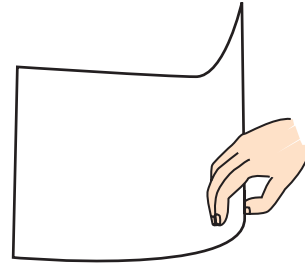
# CRICKET CAP



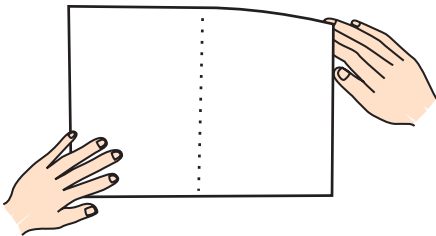
1. Cut a newspaper into two parts. The cap will be made from one part.



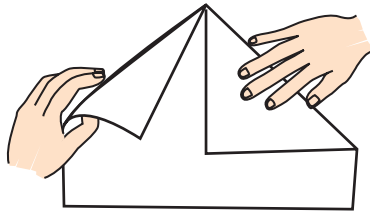
2. Fold one part in half from top to the bottom.



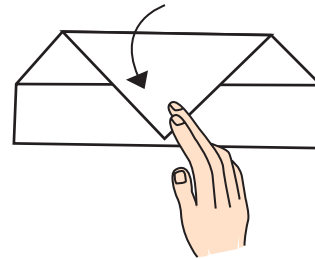
3. Then fold it from side to side and unfold it again.



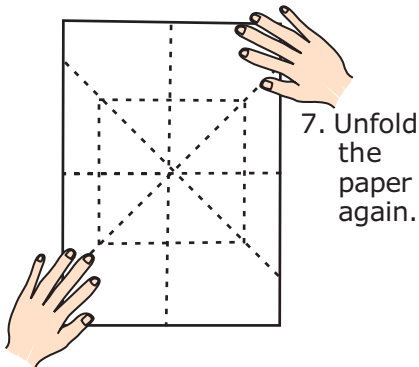
4. Fold one half of the top edge in so that it lies along the centre fold line.



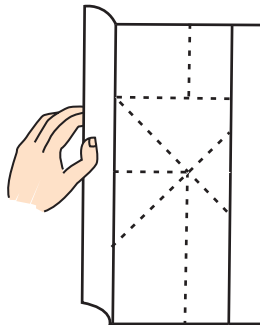
5. Repeat the same with the other half.



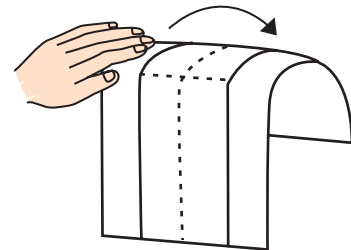
6. Fold the top down to meet the bottom edge of the paper.



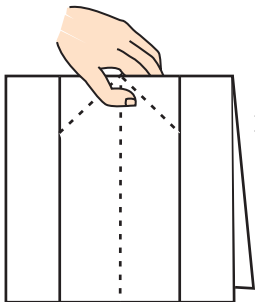
7. Unfold the paper again.



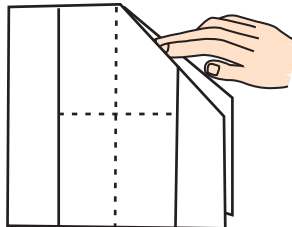
8. Fold each of the long sidelines along the fold lines.



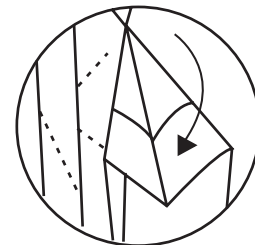
9. Then fold the paper in half away from you.



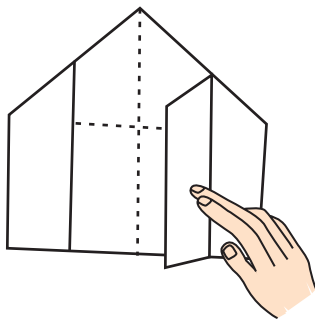
10. Push your thumb inside and forefinger on top.



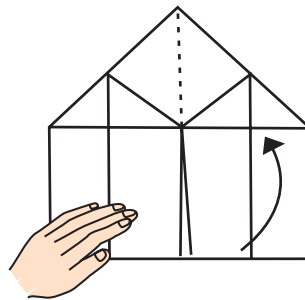
11. Push the top corner down inside itself, along the fold line.



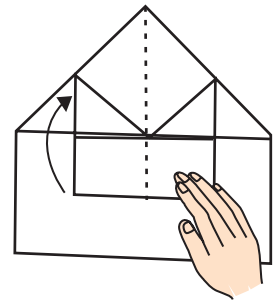
12. This is detailed drawing.



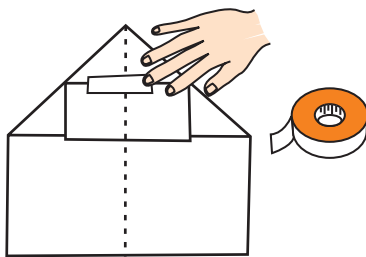
13. Fold both left and right edges to the middle line. Press them flat.



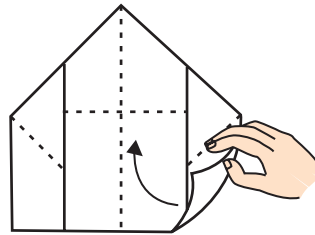
14. Then fold the bottom edge to meet the middle.



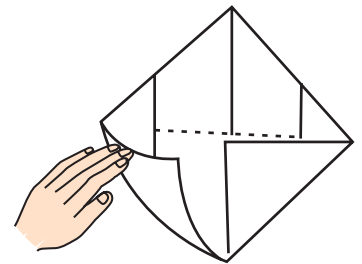
15. Fold them again over the middle.



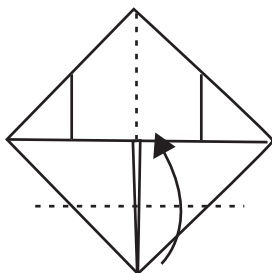
16. Fasten them down with sticky tape. Turn the paper over.



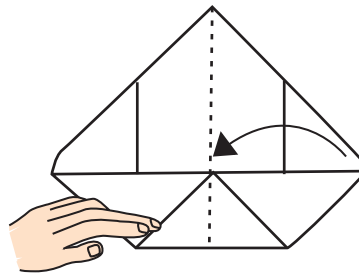
17. Fold up the bottom right-hand corner.



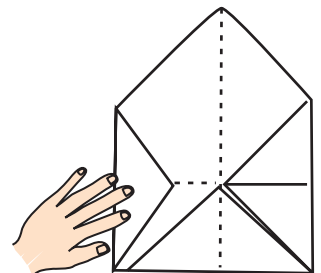
18. Then fold the left-hand corner as well.



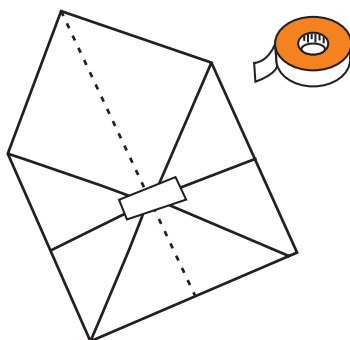
19. Fold up the bottom point to the middle.



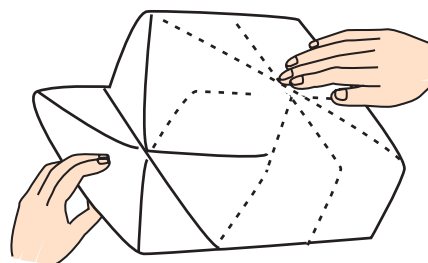
20. Then fold the right-hand corner to the middle.



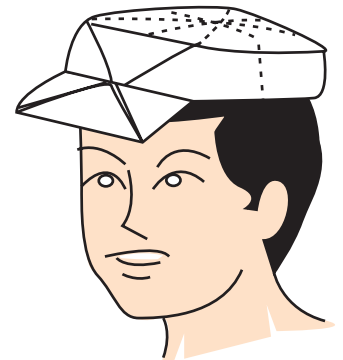
21. Fold the left corner to the middle too.



22. Fasten the corners down with sticky tape.



23. Open out and press it into shape.

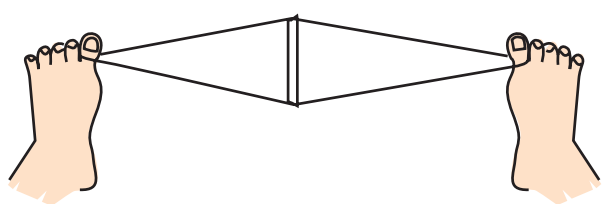
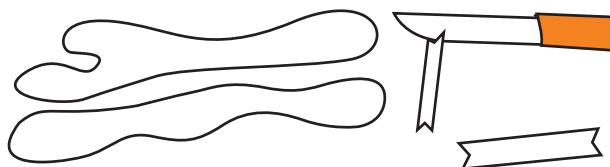


24. And then wear your CRICKET CAP.

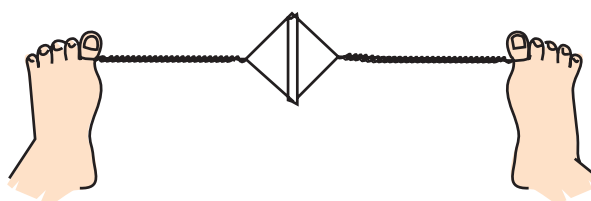
# SIMPLE SPINDLE

This is one of the most creative Indian toys.  
All it requires is a bit of string and an old ice-cream stick.

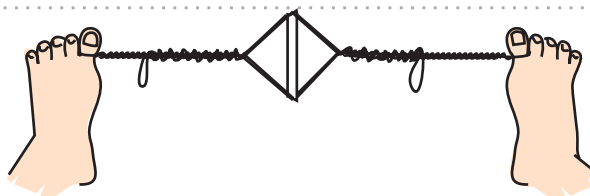
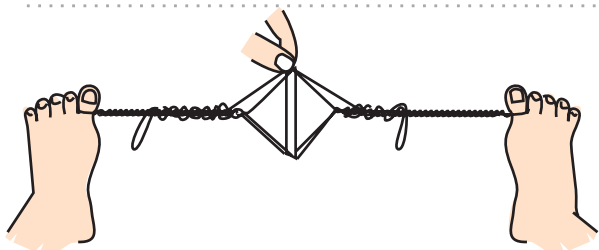
1. Take two strings each 80 cm long Tie knots in their ends to make them into loops. Take a piece of icecream stick about 6 cm long. With a knife or a blade cut 'V' notches on both its ends. The notches are to hold the threads in place.



2. Take one loop of thread. Hold the two ends of the loop between the thumbs of your feet. Insert the stick. The thread will be in tension while the stick will be in compression.



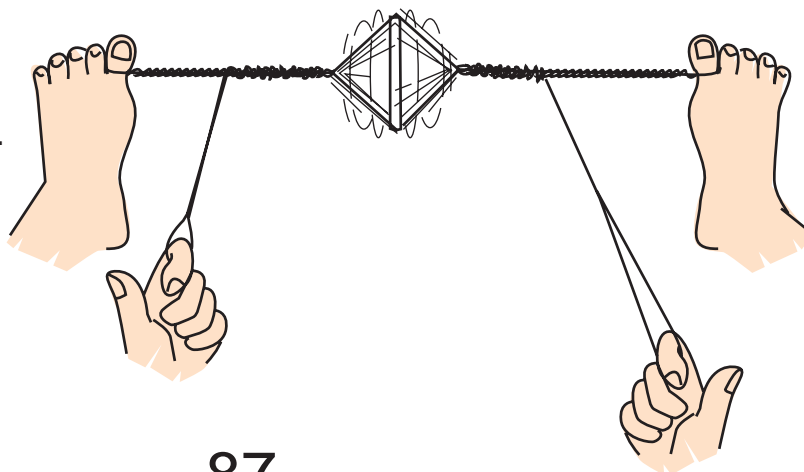
3. As in a spring toy wind the stick. The thread will wind too, and there will be twists in the thread. Hold the stick otherwise the thread will unwind in the reverse direction.



4. Now, hold on to the stick and place the other loop. Each thread of this loop will go into one 'V' notch.

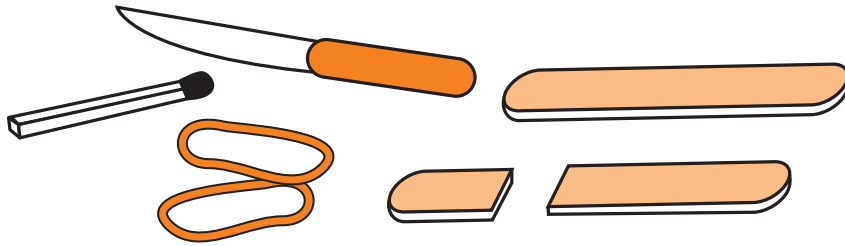
5. Make the stick unwind a little. Do this slowly, in such a way that some of the twists of the first loop get transferred to the second loop. The ends of the second loop must remain free.

6. Now hold the two free ends of the second loop and pull them gently. Watch the stick rotate. It will remind you of the old lathe machine in operation. The pulling of the second loop and then its gentle release results in a rhythmic motion. The Simple Spindle is like a solid of revolution. When the two thread triangles rotate they make cones. You can make pretty patterns in the thread triangles. When in motion they look amazing. You can also change these patterns at will.

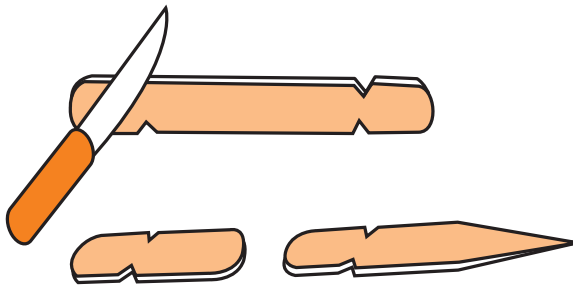


# FLICK KNIFE

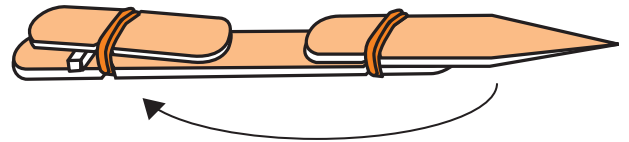
This automatic mechanical knife - a *RAMPURI CHAKU*, is fun to make and a sheer delight to play with



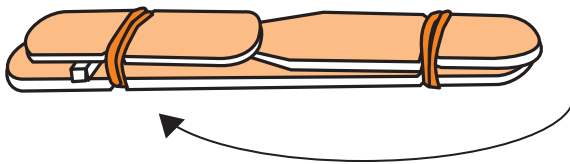
1. To make the Flick Knife you will need two wooden ice-cream sticks, two small rubber bands, a matchstick and a paper knife or blade. Cut one ice-cream stick about 3 cm from one end.



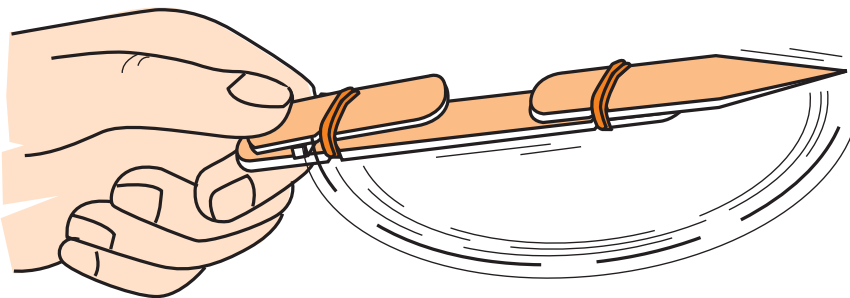
2. Cut notches in the pieces as shown. Taper the long piece so that it looks like a knife blade. Cut notches on the other ice-cream stick too, as shown.



3. Join the cut pieces on the big ice-cream stick by putting a rubber band in each pair of notches. Slip in a piece of matchstick between the small piece and the big ice-cream stick. This is the fulcrum and is part of the locking system. You can open and close it by pressing it.



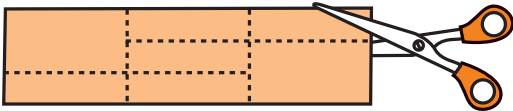
4. Now swing the blade and lock it under the small piece



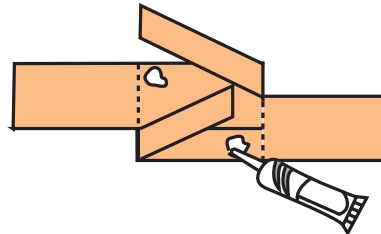
5. Now, if you press the left button, the blade will flick open in a fraction of a second.

# FAN TAILED BIRD

By attaching a simple propellor to a flapping bird you can make a beautiful fan-tailed bird.



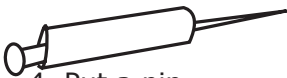
1. Take a 7.5 cm x 3.0 cm strip of bond paper. Fold its length into three equal parts. Leaving one third of the width cut two sectors along the length. Repeat the same at the other short edge.



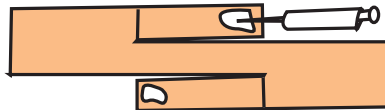
2. Fold one third of the end strips inwards and glue them.



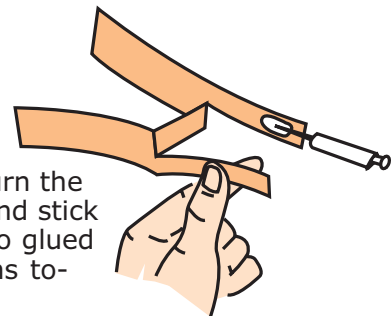
3. Cut a one centimetre long piece from an old ball pen plastic refill and flatten one of its ends by pressing it between your teeth.



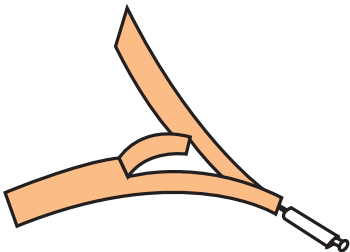
4. Put a pin through this end. The oval refill end prevents the pin from going through.



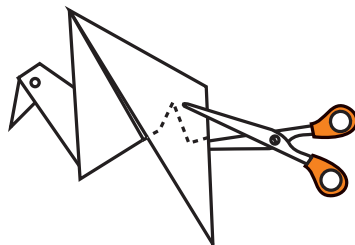
5. Apply glue (Fevibond / Vamicol is best) on the doubled up ends. Stick the end of the pin as shown in the picture.



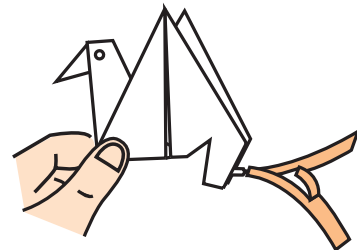
6. Now turn the strip and stick the two glued portions together.



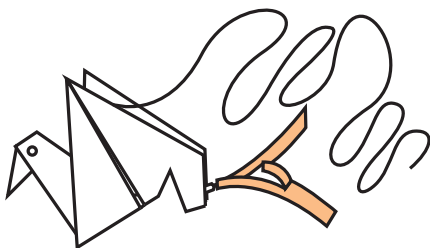
7. If you now hold the refill and blow through the wide side of this Y shaped propeller then it will rotate very fast.



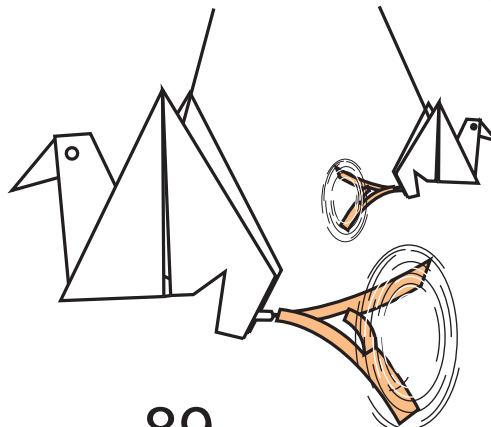
8. Fold a FLAPPING BIRD using a 10 cm square of thick paper. Cut the bird's tail as shown by the dotted lines.



9. Apply glue on both the inner portions of the tail and stick the plastic refill of the fan. Take care so that the glue does not touch the head of the pin.



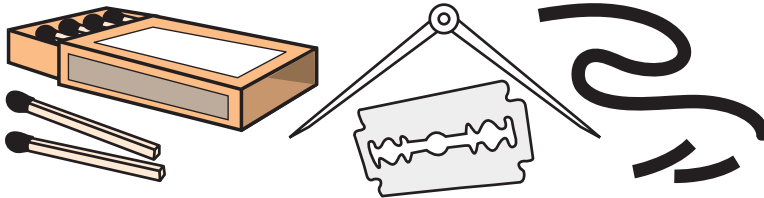
10. Tie a thread to the bird and then rotate it.



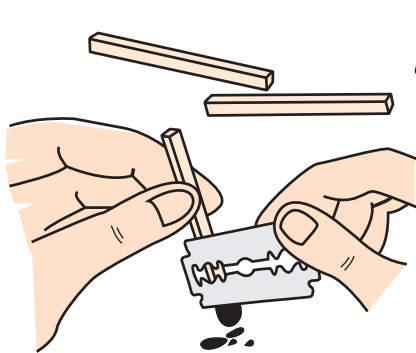
11. The tail fan will rotate giving a feel of the bird in flight.

# MATCHSTICK MODELS

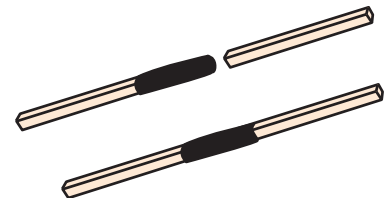
Make a simple mecano using cycle valve tubes as joints and matchsticks as members.



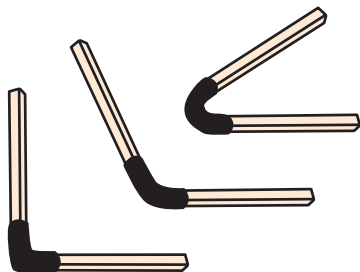
1. These matchstick models use matchsticks as the basic structural members and cycle valve tubes as the basic joints. Cycle valve tube is cheap. A packet of 100 gms. costs Rs.20/- and contains 12 metres (50 feet) of valve tube.



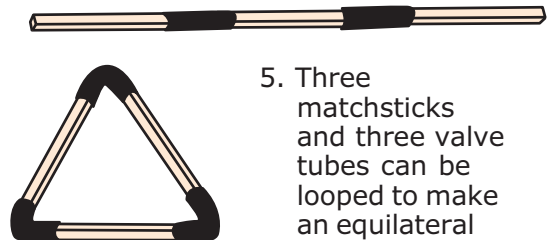
2. Cut 1.5 cms. long pieces of the valve tube. Scrape the sulphur from the matchstick heads with a blade.



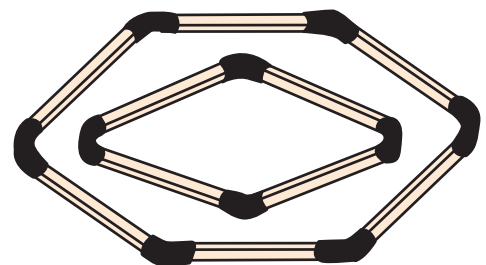
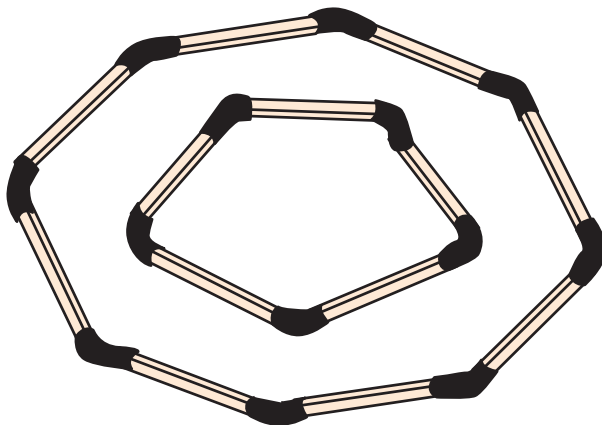
3. Push two matchsticks through the two ends of the valve tube. This is a joint-of- two.



4. This flexible joint can be used for depicting angles - acute, right, obtuse angles etc.

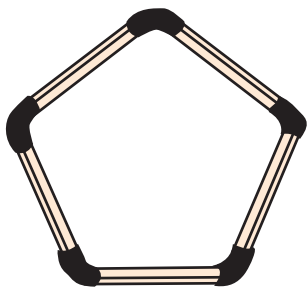


5. Three matchsticks and three valve tubes can be looped to make an equilateral triangle.

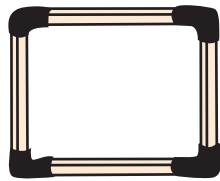
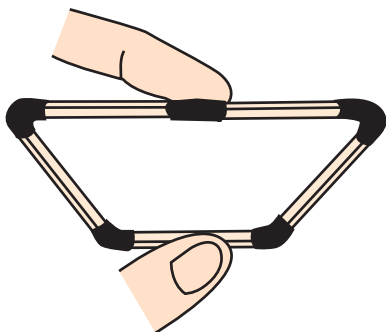


6. Other shapes like squares, rectangles, pentagons, hexagons can be made by joining more matchsticks and valve tube pieces.

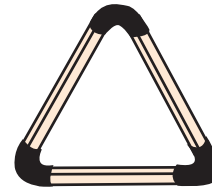
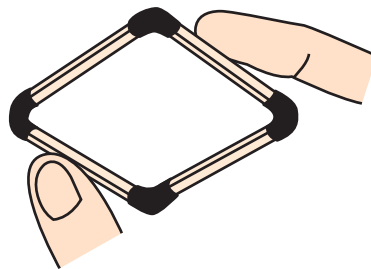




7. If you press the pentagon it changes shape and becomes boat shaped.

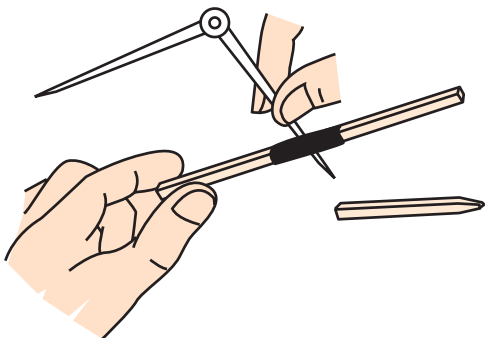


8. The square when pressed becomes a rhombus.

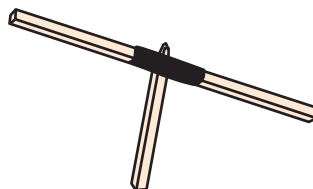


9. But no matter how hard you press, a triangle remains a triangle. The triangle is the only rigid polygon. That is why roof trusses, bridges, electricity towers are made of triangles. The triangles make them rigid and strong.

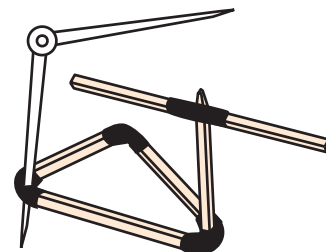
## THREE DIMENSIONAL MODELS



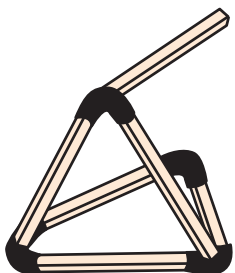
1. Pierce a hole in the valve tube joint-of- two, by poking it at right angles either with a long needle or else a thorn.



2. Insert a third matchstick (slightly sharpened at the end) in this hole. This is a joint-of-three, or simply a T-joint.

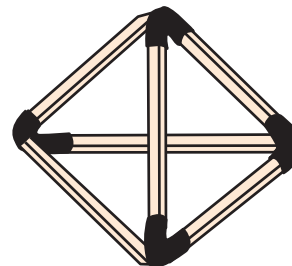


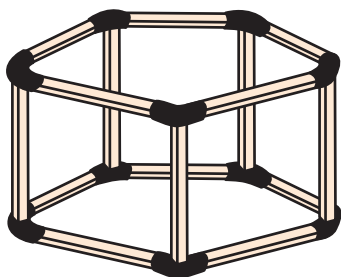
3. Take the equilateral triangle and poke holes in its valve tube joints with a thorn. Now insert the three matchstick ends of the T-joint in the holes of the triangle.



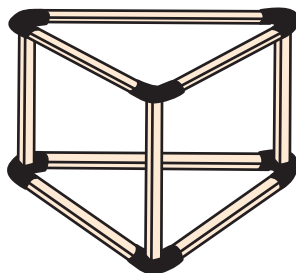
4. This structure is called a TETRAHEDRON. It has 4 corners, 6 edges and 4 distinct surfaces.

5. All its surfaces are equilateral triangles. Triangles are rigid. So this triangular house is very strong.

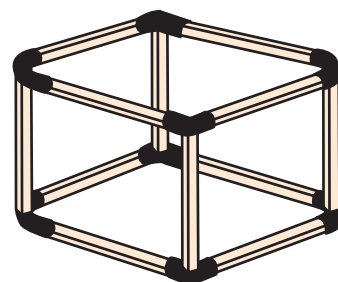




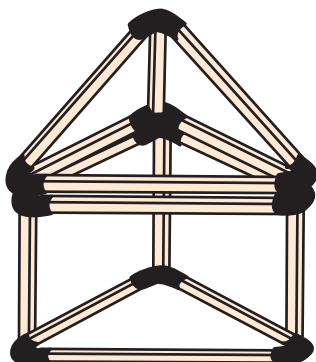
6. PENTAGONAL BOX



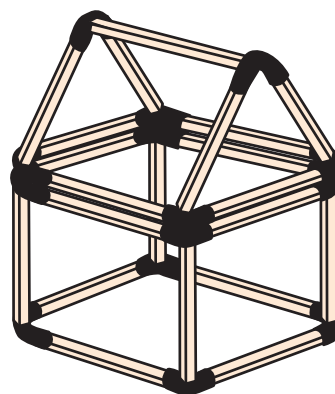
7. In a similar manner two separate triangles can be joined together using three matchsticks to make a PRISM.



8. Two separate squares can be joined with four matchsticks to make a CUBE.



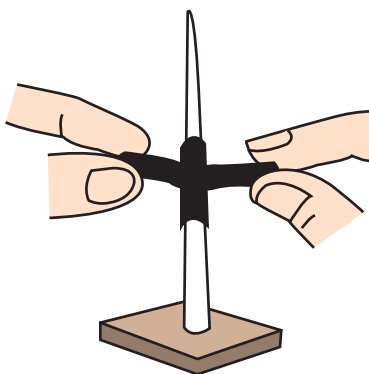
9. Several of these three-dimensional structures can be put together to make different kinds of houses and other configurations. You can play with this simple meccano to create your own models.



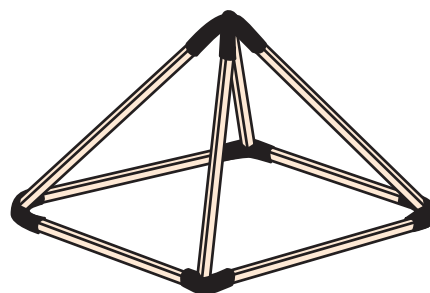
## JOINTS OF FOUR, FIVE AND SIX



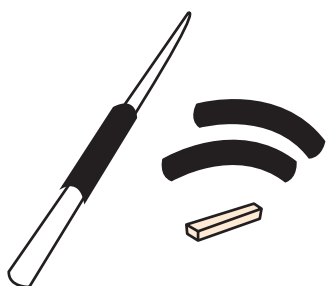
1. Take two pieces of valve tube about 2 cms. long. Weave a thorn through the hole of one. Then pierce the thorn through the centre of the other valve tube.



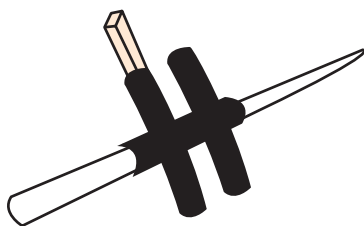
2. Pull both the ends of the second valve tube and slide it over the first one. Gently remove the cross, joint- of- four from the thorn.



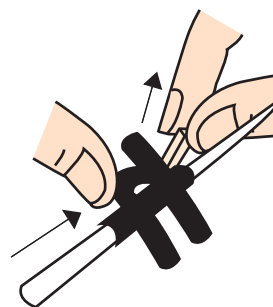
3. Use these joints to make a PYRAMID



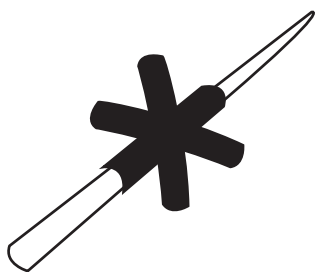
4. Make a joint-of-four but do not remove it from the thorn. Just like the second, insert a third valve tube.



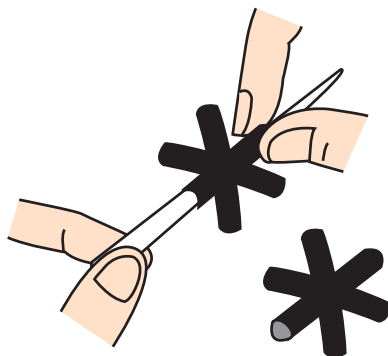
5. The second and the third tubes are at right angles to the first tube. Insert a small piece of matchstick in any of the four free legs of the 'H'.



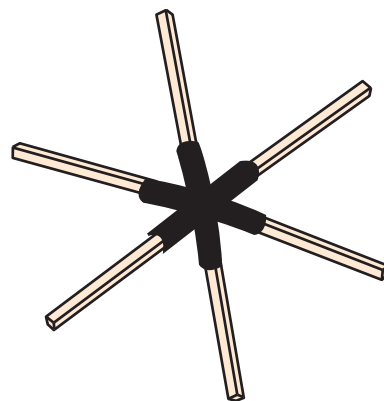
6. Weave this matchstick needle through the centre of the other leg of the 'H'.



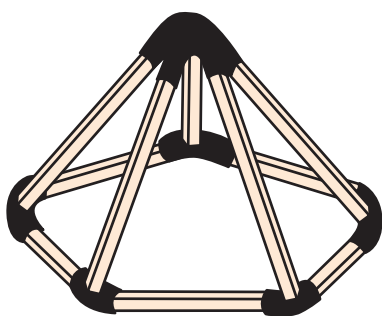
7. Now remove the thorn and phase out the six valve tube legs to form a star.



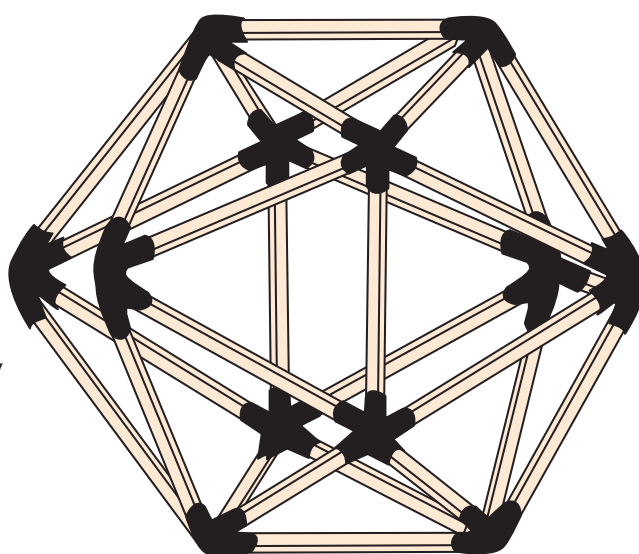
8. This is a joint-of-six. For a joint -of-five, simply cut one of the legs of the 'H'.



9. You can attach six matchsticks to the star joint.

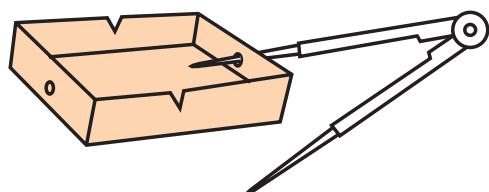


10. Assemble twelve joints-of-five and thirty matchsticks to make an ICOSAHDREDON. One pentagonal face of the icosahedron can be flexed in to make an IGLOO. With joints of 2, 3, 4, 5 and 6, and matchsticks as members there are many different kinds of models and structures which you can make. This is a very interesting way to learn solid geometry.

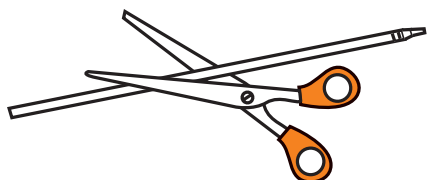


# GO-NO-GO MATCHBOX

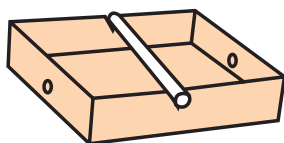
Keeping the thread tight keeps this match box in place.  
Loosening the thread makes this matchbox slide.



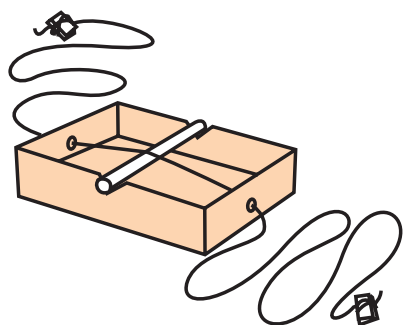
1. Take a cardboard matchbox drawer and cut two V notches in the middle of its two long edges. Make a clear hole in the centre of both ends of the drawer.



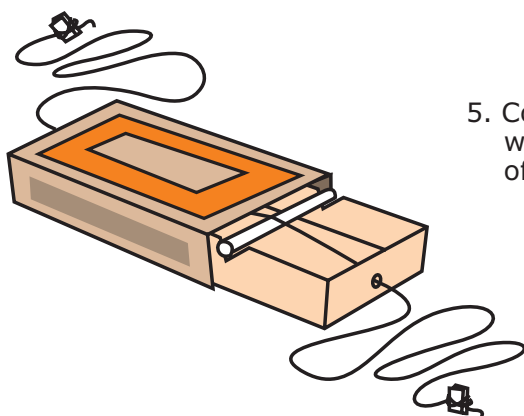
2. Cut an old ball pen refill equal in size to the width of the drawer.



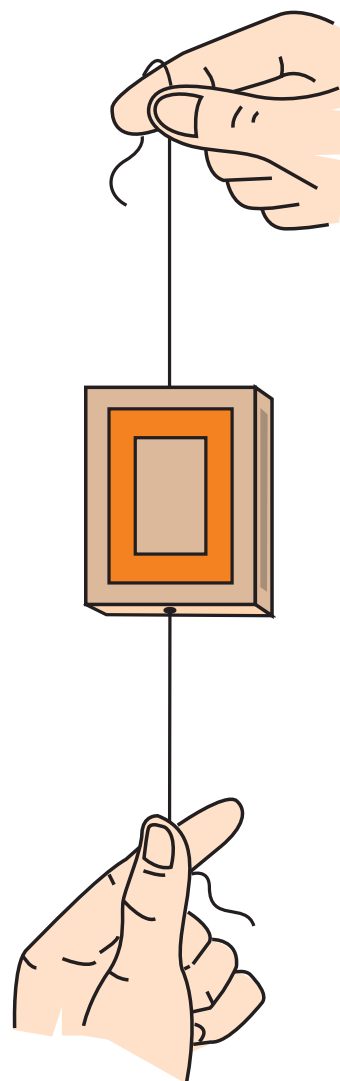
3. Fix the refill in the V notches of the drawer with a dab of glue.



4. Weave a 70 cm. long string through the two holes of the drawer. The thread should go over the refill. Tie two pieces of folded paper at the two ends for a good grip.

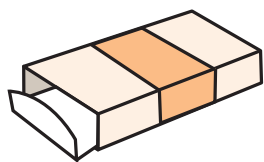


5. Cover the drawer with the outer shell of the matchbox.

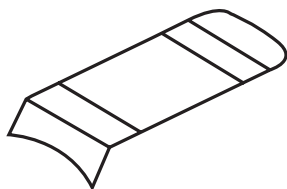


6. Hold the two ends of the string upright. If the string is kept loose then the matchbox slides down. But if you tighten the string it rubs against the refill and brakes the matchbox to a stop. This obedient matchbox is based on the principle of friction and gravity.

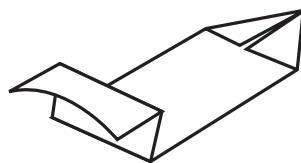
# LEAPING FROG



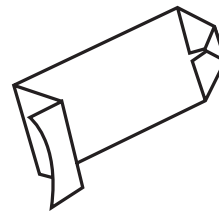
1. Take an old cigarette packet and...



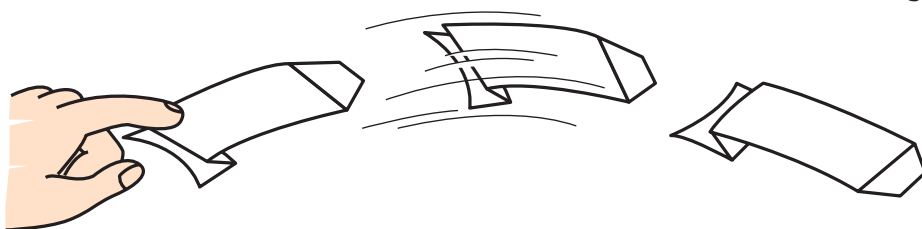
2. .... remove its inside drawer made of thin card sheet.



3. Fold the two corners on the top to the middle to make a triangular head.



4. Fold the tip of the triangular head inwards.



5. The folds on the left side of the drawer act as a very fine spring. Turn the frog upside down and press the spring with your index finger to make it leap. Paint the frog green and stick two eyes to make it look like a real frog.

# SIREN

You need a rubber balloon.

*How to make it*

Blow air into the balloon. Hold the opening at the top with both hands as shown so that the air cannot escape. Stretch the balloon outwards and allow a little air to pass out. This will produce a fascinating sound. A little practice enables you to produce a variety of sounds.

*Try out*

Try using balloons of different sizes.

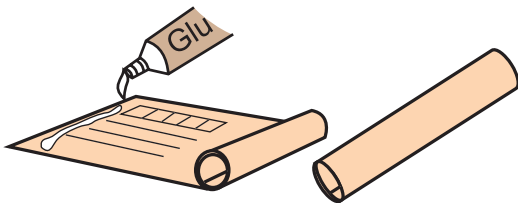
*Find out*

Is the working of this toy similar to that of the paper whistle? Why is there no sound when the opening is big and the air rushes out?

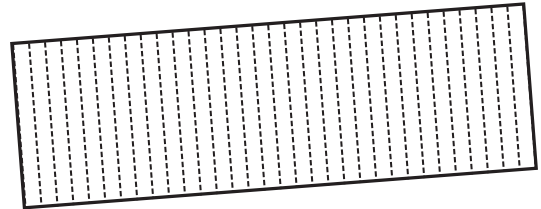


# MAGIC FAN

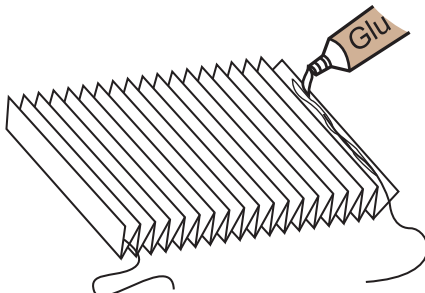
This captivating traditional folk toy could at one time be bought in village fairs. You cannot buy it today but you can make it at home in no time at all.



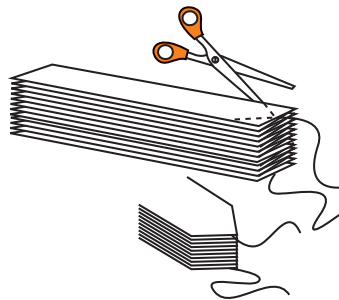
1. Roll and stick an old postcard to make a cylindrical reel, with a diameter of about 2 cm.



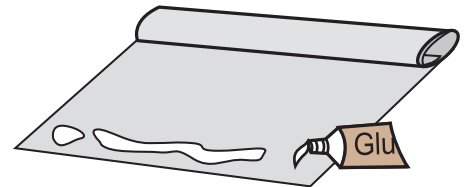
2. Fold a sheet of glazed newspaper (10 cm x 50 cm) into a fan with 32 creases. Make sure that all the zigzag creases are of the same width.



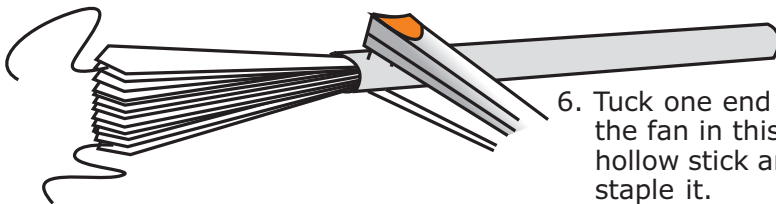
3. Fix a thread each on the two extreme ends of the corrugated fan. About 5 cm of the thread should be left trailing out.



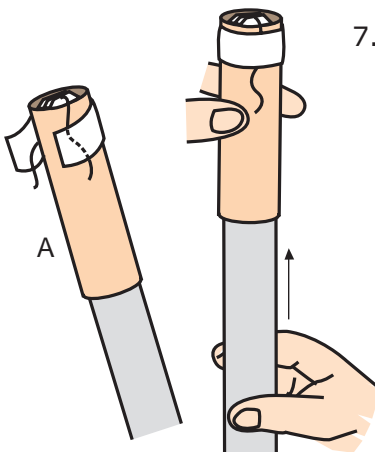
4. Trim off the triangular edges of the folded fan as shown.



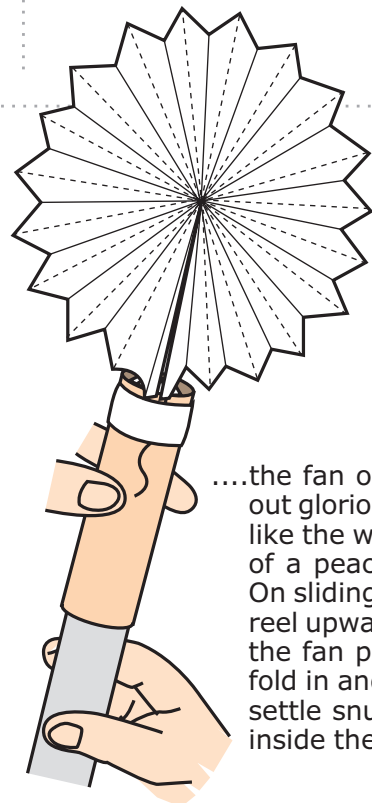
5. Cut a square (20 cm x 20 cm) from a newspaper. Roll it into a hollow stick and glue its edge.



6. Tuck one end of the fan in this hollow stick and staple it.



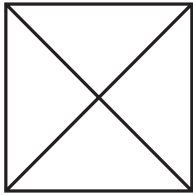
7. Slip the postcard reel over the fan. The top of the reel and the fan should be at the same level, with the free ends of the threads hanging out. Fix the threads to the postcard reel with cello-tape (Fig A). If you now hold the newspaper stick with one hand and slip down the postcard reel with the other...



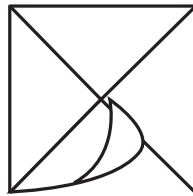
....the fan opens out gloriously like the wings of a peacock. On sliding the reel upwards, the fan pleats fold in and settle snugly inside the reel.

# SOLAR PINWHEEL

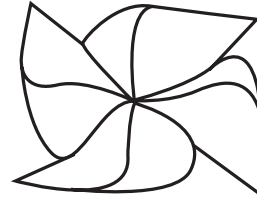
This simple device uses the sun's energy to rotate a pinwheel.



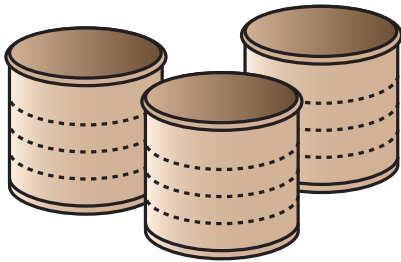
1. Fold a square paper as shown to make a windmill.



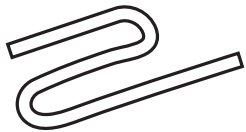
2. Glue its corners to the centre.



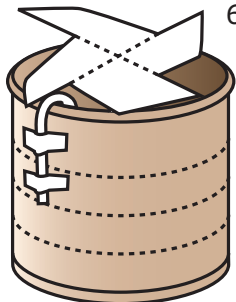
3. Make a single dent (not a hole) with a pencil at the centre of the windmill.



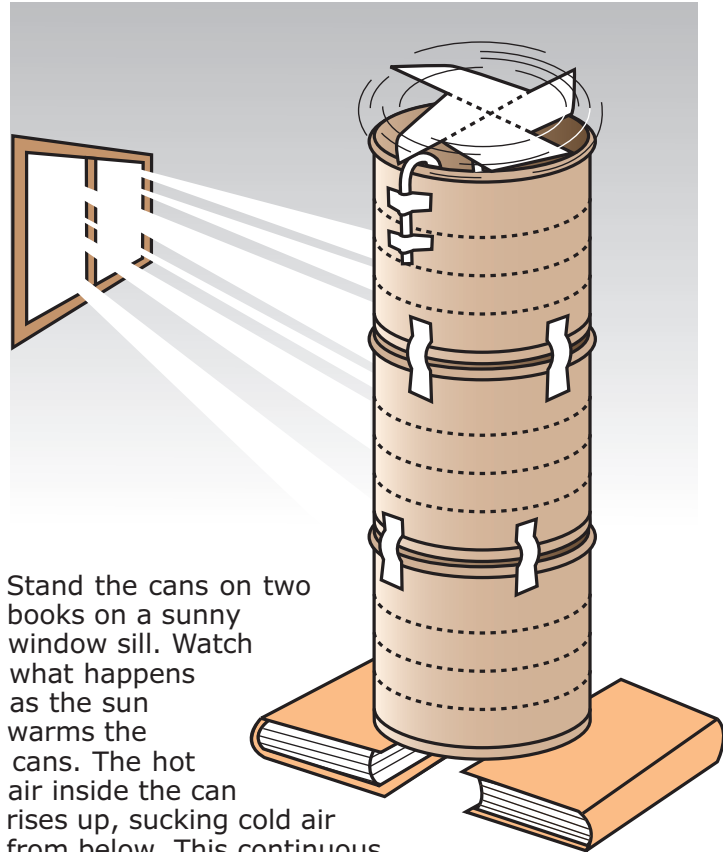
4. With the help of an adult, cut the bottom out of three old tin cans. Paint the outside of the cans black. Join the three cans together with some tape, to make a long metallic hoop.



5. Get a piece of thin wire and bend it as shown.



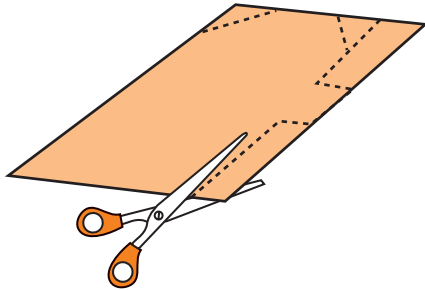
6. Tape the wire on the top of the can and balance the windmill on its tip.



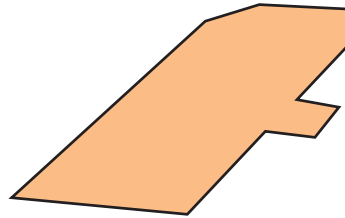
7. Stand the cans on two books on a sunny window sill. Watch what happens as the sun warms the cans. The hot air inside the can rises up, sucking cold air from below. This continuous convection current keeps the pinwheel rotating. Instead of joining three tin cans to make a hollow cylinder, you can make use of the metallic hoop at the end of the soft broom - the 'Phool Jhadu'. How can you make this windmill turn on a day when the sun is not shining?



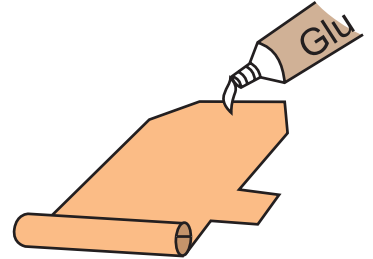
# A PAPER FLUTE



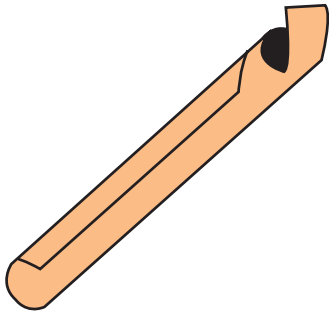
1. Mark out the pattern on a piece of paper.



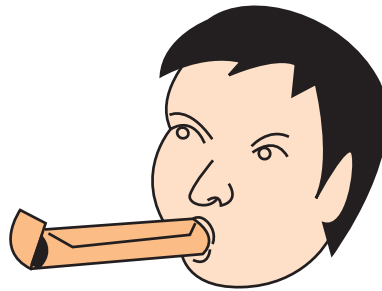
2. Then cut out the rectangular shape with a small square flap on one edge.



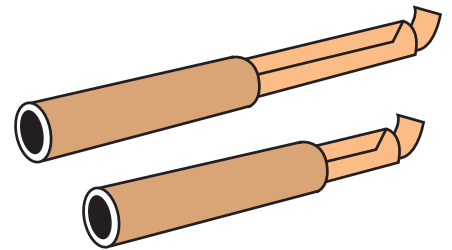
3. Roll the paper like a cigarette, gluing its other edge so it does not open.



4. This simple roll of paper with a little flap bent over one-end makes a nice paper flute.

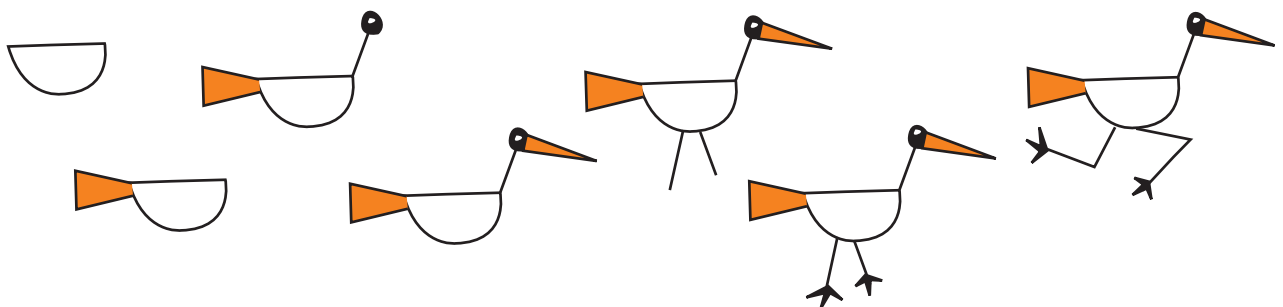


5. If you place the end with the flap inside your mouth then you have to blow out to play it. Otherwise, you can have the flap end outside, in which case you suck gently, thus vibrating the flap against the tube.



6. Now, insert the tube inside a used thread reel. Vary the length of the vibrating column and see if there is some change in the sound.

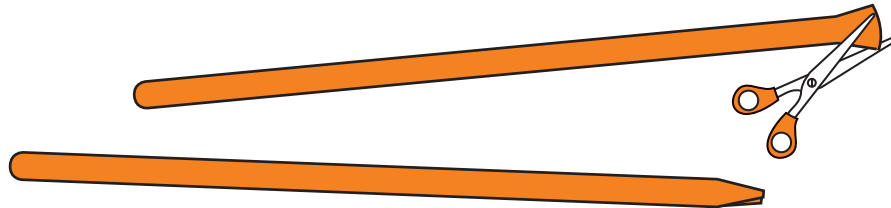
# EASY TO DRAW



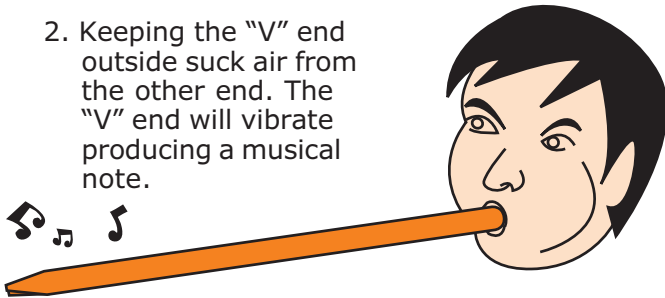


# SODA-STRAW FLUTE

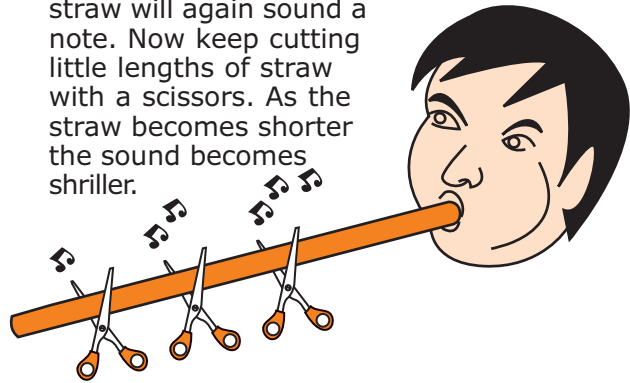
1. Flatten out one end of a soda-straw. Nip, both long edges of this end with a scissors with a "V" point.



2. Keeping the "V" end outside suck air from the other end. The "V" end will vibrate producing a musical note.



3. You can also keep the "V" end inside the mouth and blow out air. The straw will again sound a note. Now keep cutting little lengths of straw with a scissors. As the straw becomes shorter the sound becomes shriller.



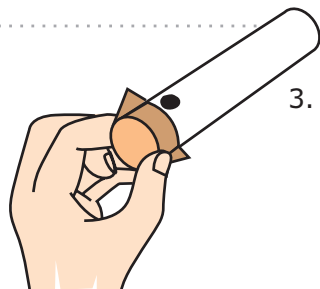
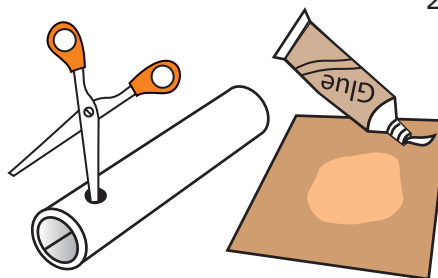
4. Cut a few holes on the straw to make it into a flute. By opening and closing these holes you can play a few notes on the soda-straw flute.



# VOICE AMPLIFIER

2. Make a hole of about 1 cm diameter near one end of the tube. Stick a piece of kite paper near this end such that no creases are formed on it. The toy is ready.

1. You need a card paper tube, kite paper, glue and scissors.



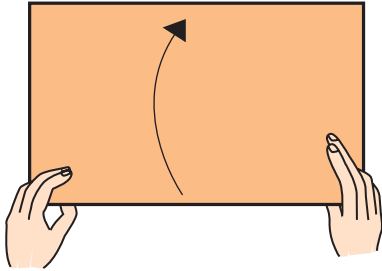
3. It works like a sound box which amplifies your voice when you bring your lips near the hole to speak.

4. Try using different kinds of paper. Why does your voice get amplified?



# THE IMPOSSIBLE PUZZLE

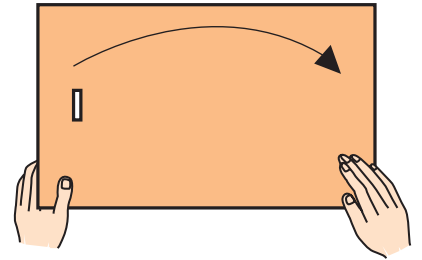
This is a very good puzzle to baffle your friends with.



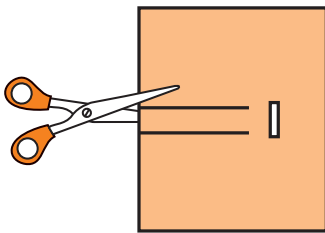
1. Take a rectangle of paper about 25 cm long and 15 cm wide. Fold the rectangle in half from bottom to top.



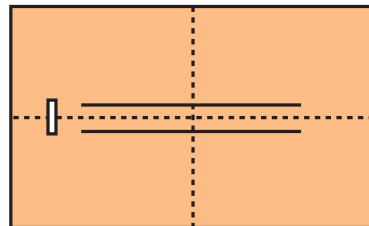
2. Cut a little slot at one end of the paper as shown.



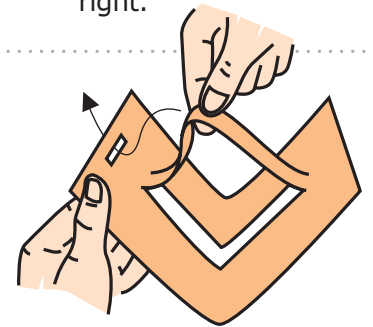
3. Then unfold the rectangle. Now fold the rectangle in half from left to right.



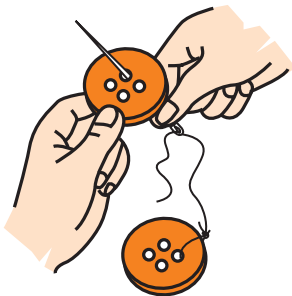
4. From the folded side, mark two parallel cuts that go towards, but do not quite touch the slot.



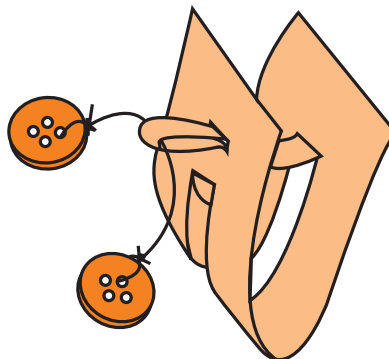
5. Unfold the rectangle. This should be your finished result.



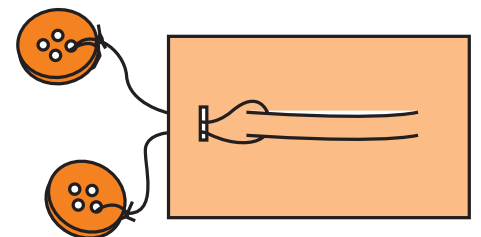
6. Now, bring the ends of the paper towards each other, but not quite together. Thread the strip made by the two parallel cuts in Fig (4), through the slot, so that you get a little loop sticking out.



7. Thread the buttons on to a length of cotton and knot the ends so that the buttons do not fall off.



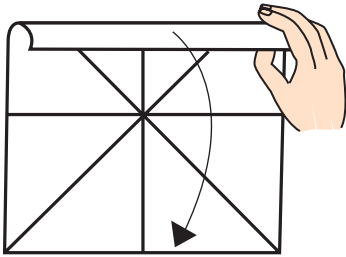
8. Put one of the buttons through the loop.



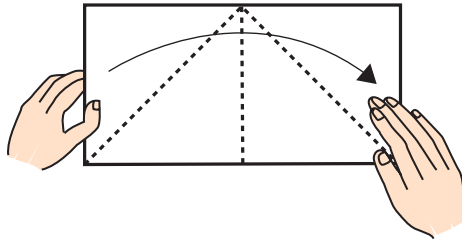
9. Fold the paper back into place so that it looks like this. Show the puzzle to your friends. Ask them if they can remove the buttons without breaking the cotton thread or tearing the paper. The secret is simply to repeat the steps in 6, 8 and to pull the buttons back through the loop.

# A FIVE STAR TREAT

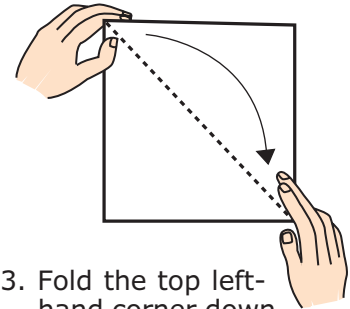
With a few, quick folds and with just one cut of the scissors, you can make five stars in one sheet of newspaper.



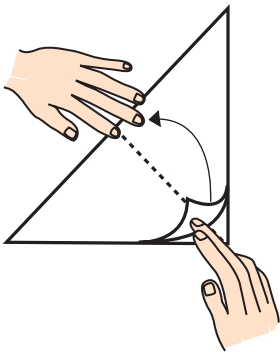
1. First, cut out a large square from a double spread newspaper sheet. Fold the square in half from top to bottom.



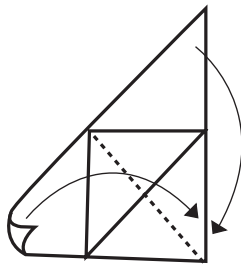
2. Fold it in half from left to right.



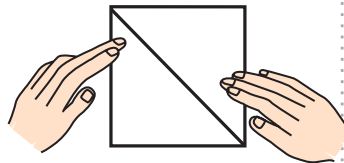
3. Fold the top left-hand corner down to meet the bottom right-hand corners.



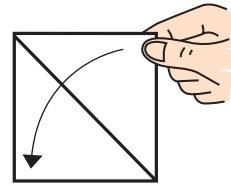
4. Fold the top right-hand corner up to meet the middle of the diagonal slope.



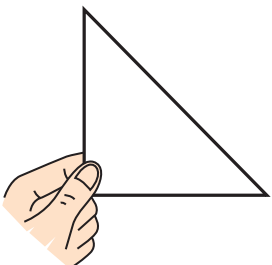
5. Fold both the top right-hand and bottom left-hand corners over to meet the bottom right-hand corners.



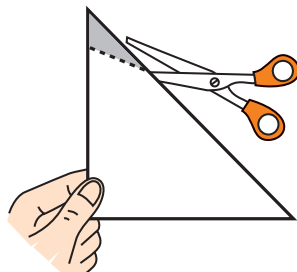
6. Press the paper flat and turn it over.



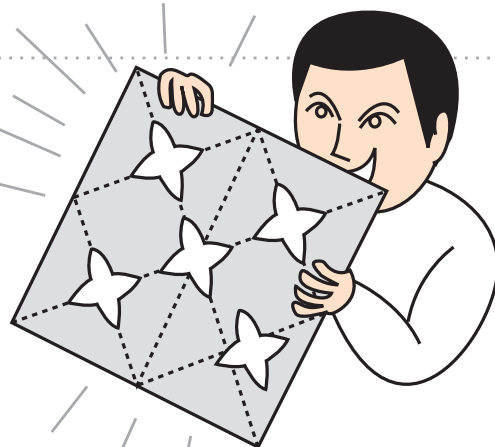
7. Fold the paper in half, from the top right-hand corner to the bottom left-hand corner, along the diagonal fold line.



8. This way you will be making a triangle.



9. With a scissors carefully cut away the shaded part.



10. Open out the paper carefully and you will have five stars glittering at you.

# MATCHSTICK MATCHING

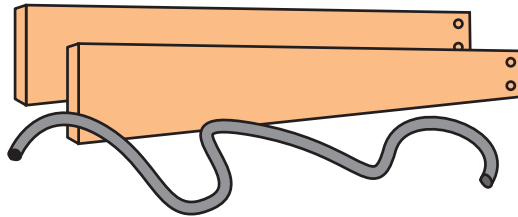
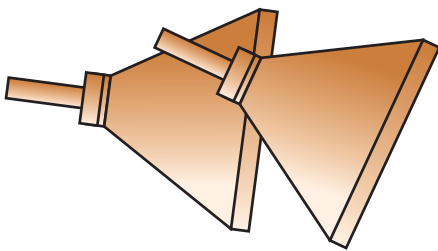
Move only as many matches as directed and create as many squares as requested.  
(Squares can overlap or have corners in common.)

|                | CHANGE 2 STICKS | CHANGE 3 STICKS | CHANGE 4 STICKS |
|----------------|-----------------|-----------------|-----------------|
| MAKE 2 SQUARES |                 |                 |                 |
| MAKE 3 SQUARES |                 |                 |                 |
| MAKE 4 SQUARES |                 |                 |                 |
| MAKE 5 SQUARES |                 |                 |                 |

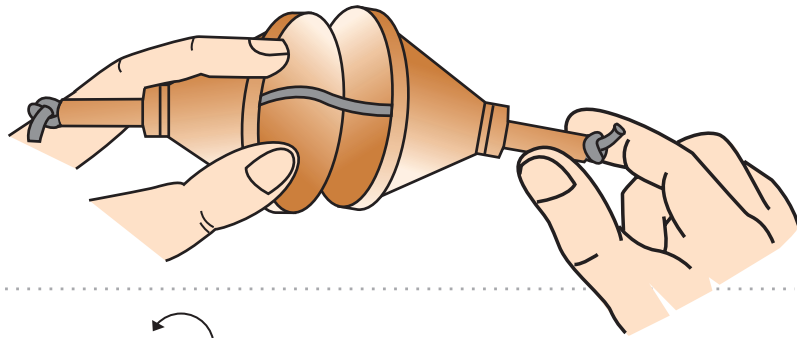
# DOUBLE CONE

Most things slide down a ramp, but this double cone seems to defy gravity and climbs uphill. How?

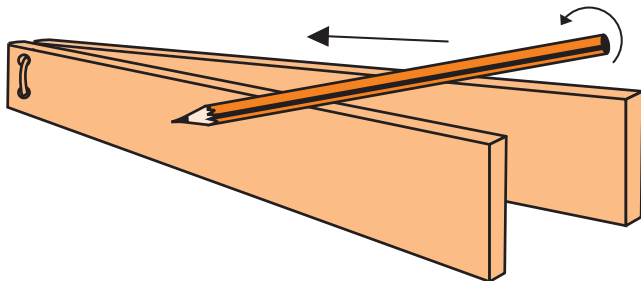
1. You need two funnels, an old cardboard and a piece of cycle valve tube.



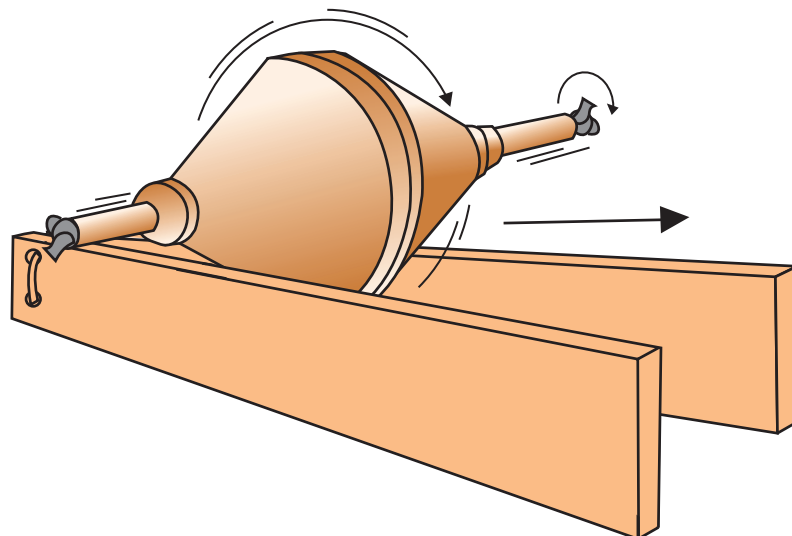
2. Mate the large circular ends of two plastic funnels and weave a cycle valve tube through them. Stretch the valve tube and tie knots at both its ends. The two funnels make a profile of a double cone.



3. Make a ramp out of two similar pieces of old cardboard. Place a cylindrical pencil on the higher end of this incline. What happens? As is to be expected the pencil rolls down the incline.

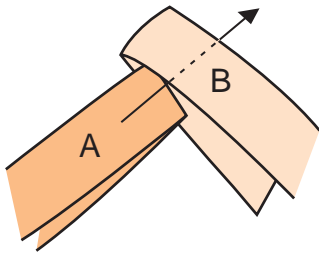


4. Now place the double cone on the lower end of the incline. The double cone tends to climb upwards. Why? The reason being that when the double cone is kept on the lower end of the ramp, its center of gravity is higher than the road level. So there is some stored potential energy in the double cone which gets converted into kinetic energy.

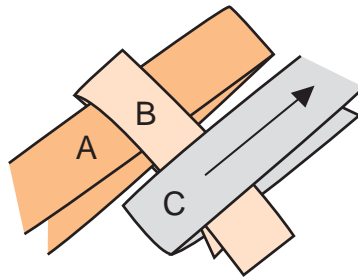


# WOVEN FISH

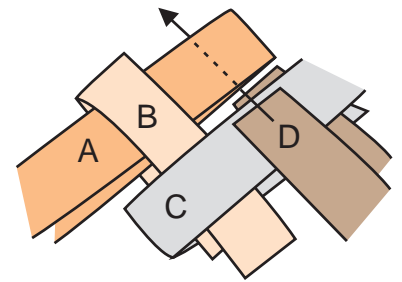
You will need several long rectangular strips of slightly stiff paper for weaving this fish. Fold four long strips of paper (2 cm wide, 50 cm long) in half. These strips have been shown in different designs and have been named A, B, C and D. Don't turn around the strips too much.



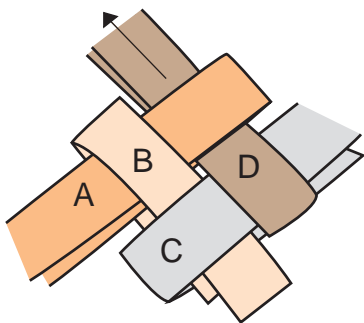
1. Take strips A and B and put A inside B as shown.



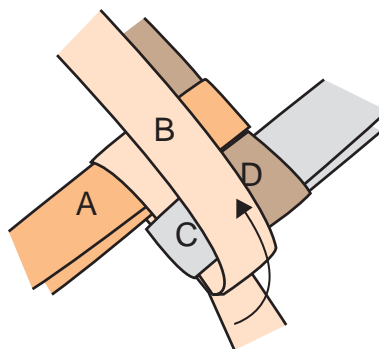
2. Weave strip C into place.



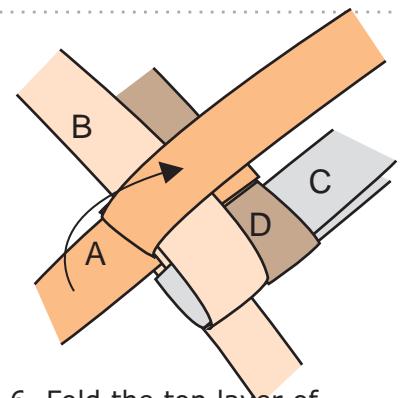
3. Now, weave strip D into place.



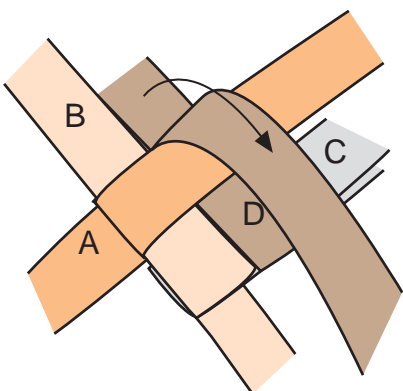
4. Pull the strips to make a paper knot.



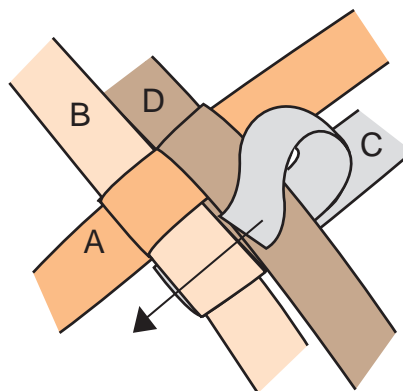
5. Fold the top layer of strip B up over the knot.



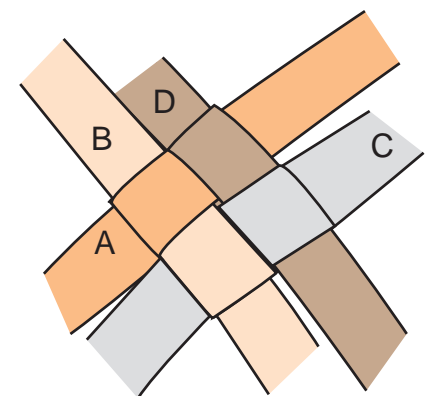
6. Fold the top layer of strip A up over the knot.



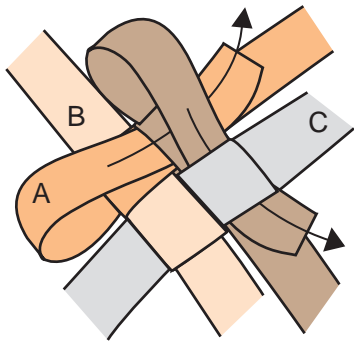
7. Now fold the top layer of strip D over the knot.



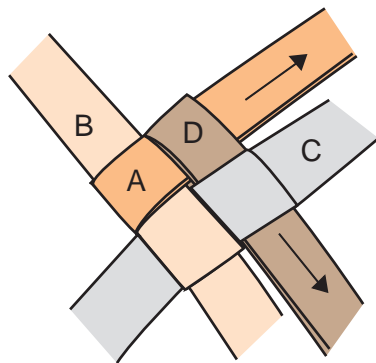
8. Fold top layer of strip C over the knot. Take care to weave it through.



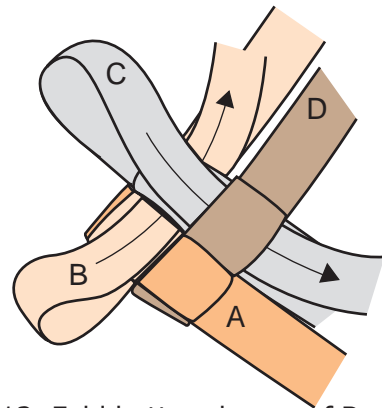
9. The design should now look like this.



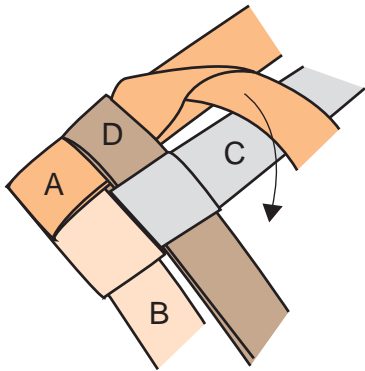
10. Fold over the bottom layers of strips A and D and weave them through.



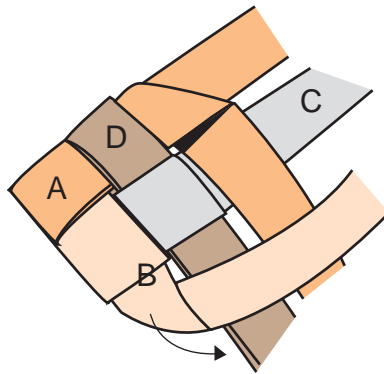
11. Pull the strips tight. Turn the paper over from top to bottom.



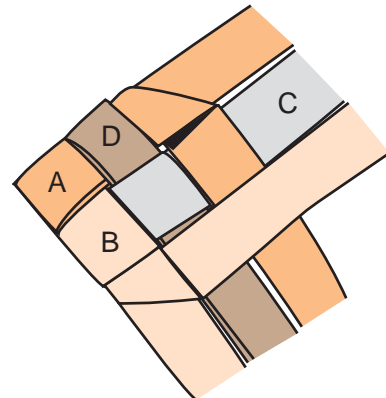
12. Fold bottom layers of B and C and weave them. Upturn paper.



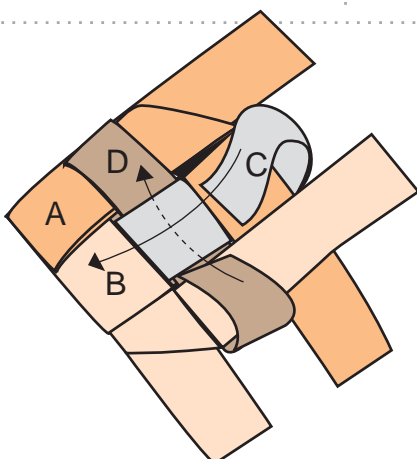
13. Fold the top layer of strip A backwards.



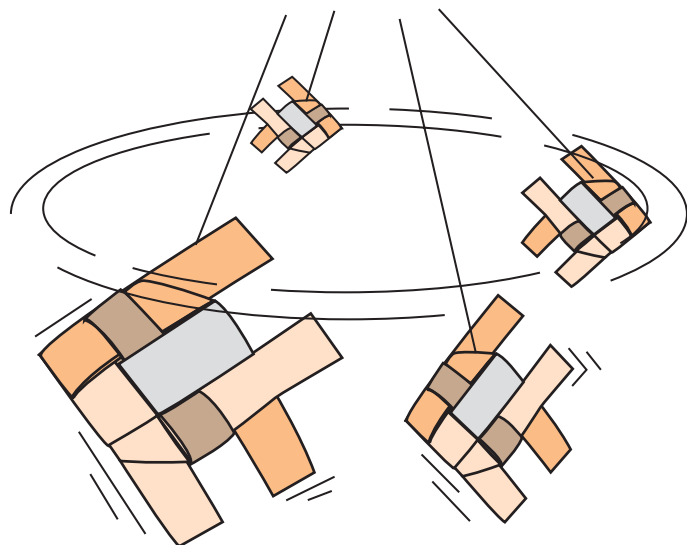
14. Fold the top layer of strip B backwards.



15. The design should now look like this.



16. Trim each strip to the same length. Don't trim them too short. Tuck the double strips C and D inside the body of the fish. Cut ends to make the tail of the fish. Make a mobile.



# SIMPLE RAIN GAUGE

Using a plastic throw away water bottle you can make a very simple rain gauge.  
It costs almost nothing to make this nice apparatus.



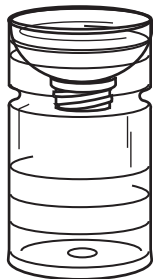
1. Take a 1 litre plastic water bottle. With a sharp knife cut its neck on the cylindrical part.



2. The top end will act like a funnel.



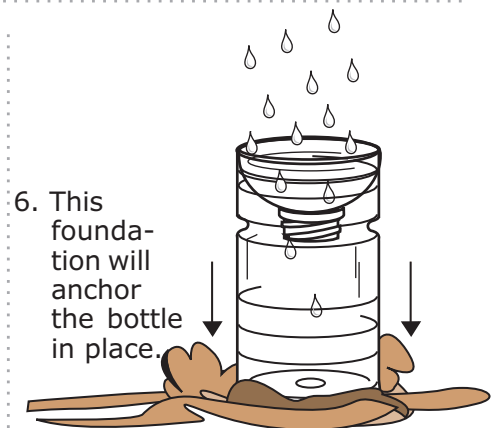
3. Invert the top to make a funnel.



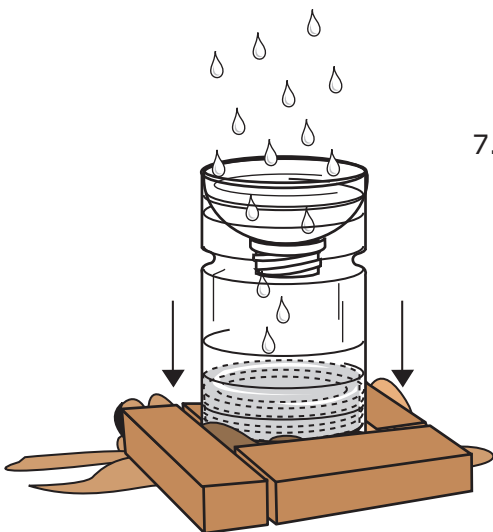
4. This funnel will prevent evaporation of water.



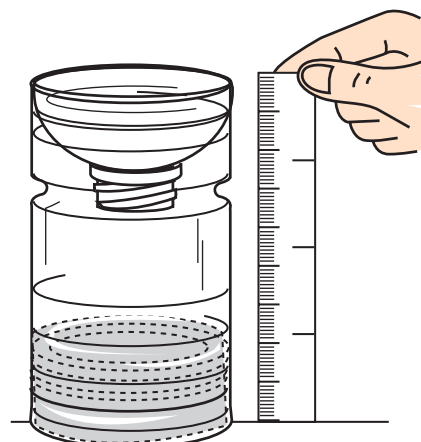
5. An empty plastic bottle being light will fall down or fly away in the slightest breeze. So dig a hole and bury the lower end of the bottle in the ground.



6. This foundation will anchor the bottle in place.



7. You can also place the bottle between four bricks as shown. This will keep the bottle in place and prevent it from toppling.

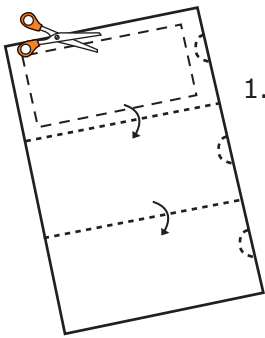


8. You can periodically measure the rainfall with the help of a scale.

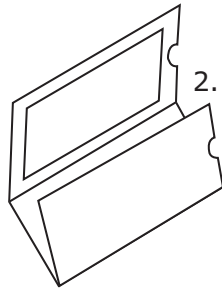


# A COLOURFUL SURPRISE

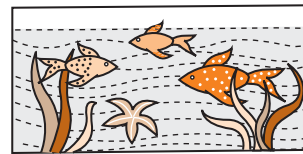
You need card sheet, an old transparency, glue, scissors and sketch pens to make this toy. As you pull the transparency the outlines of the fishes in the aquarium surprisingly become colourful!



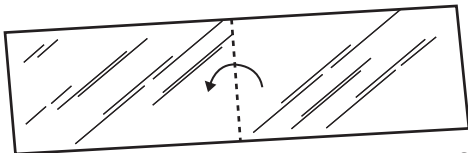
1. Take a card sheet 21 cm x 12 cm. Fold it into three. Cut out a window from the top rectangle. Cut semicircles on the right edge.



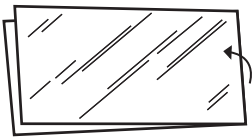
2. Fold the card sheet into such that the window comes on top. This is the folder.



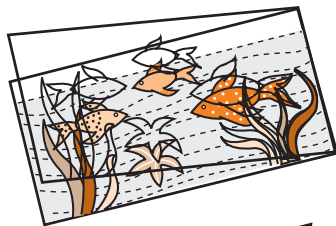
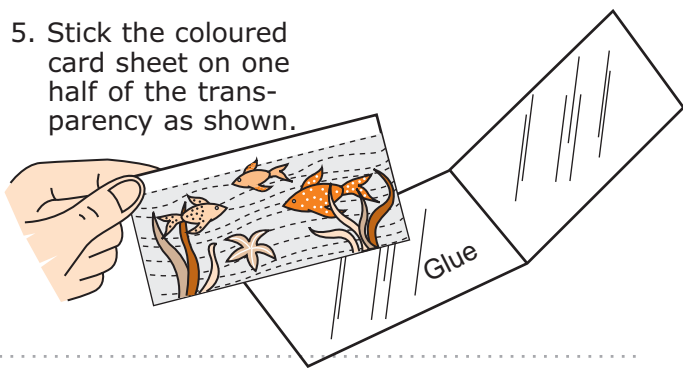
3. On a white card sheet 6.5 cm x 6cm draw a picture of an aquarium with fishes swimming. Colour the fishes.



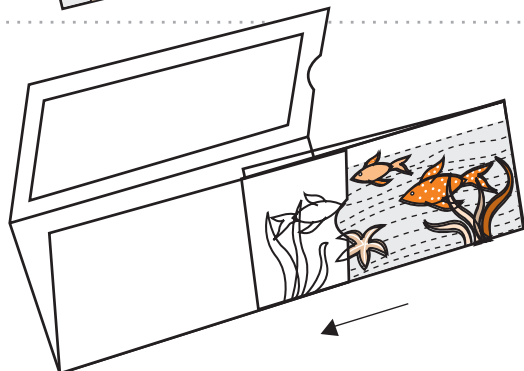
4. Cut a piece from an old transparency 6.5 cm x 12 cm. Fold it into half.



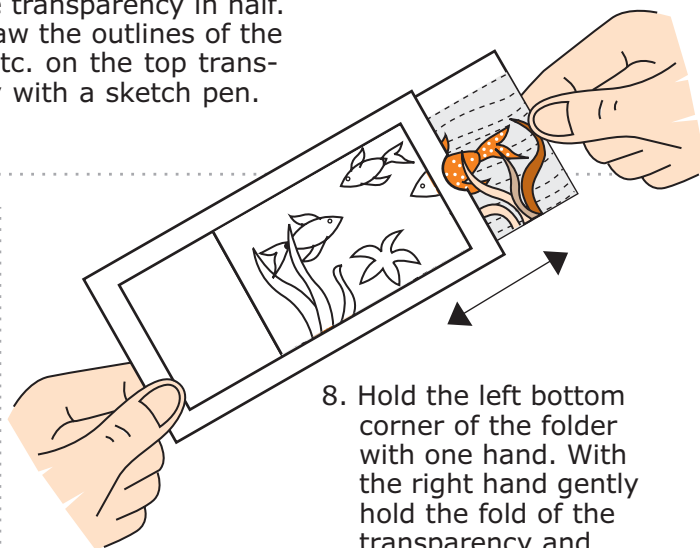
5. Stick the coloured card sheet on one half of the transparency as shown.



6. Fold the transparency in half. Now draw the outlines of the fishes etc. on the top transparency with a sketch pen.



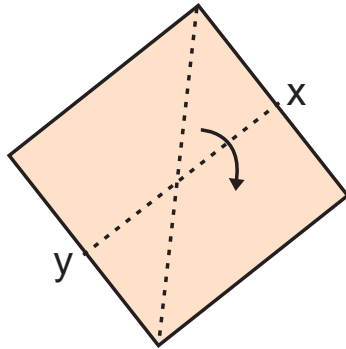
7. Slide the transparency in the folder. The colourful card sheet will be hidden. The transparency with the outline will be on top. Now close the folder window.



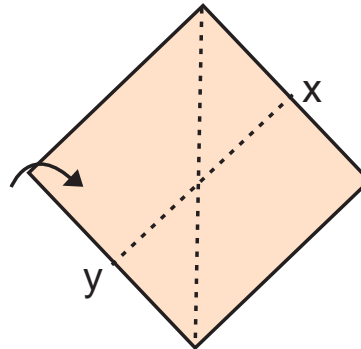
8. Hold the left bottom corner of the folder with one hand. With the right hand gently hold the fold of the transparency and pull it out. You will be surprised to find a colourful aquarium emerge out.

# GRID OF EQUILATERAL TRIANGLES

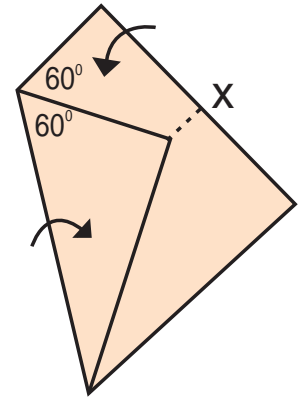
You could easily fold a grid of equilateral triangles in a paper square. Using nets of these triangles, you could fold a number of 3-D shapes Tetrahedrons, Octahedrons etc.



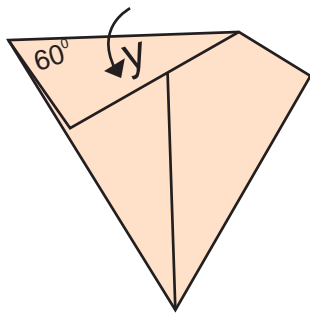
1. Cut the biggest square from an A4 size Xerox paper. Fold the middle crease to make two equal rectangles.



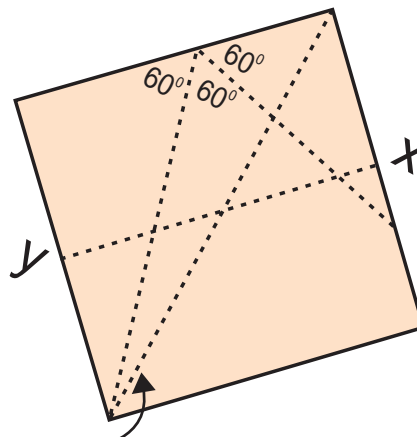
2. Open the square and fold the left hand corner and move it on the midline (XY) till the left edge passes the bottom corner.



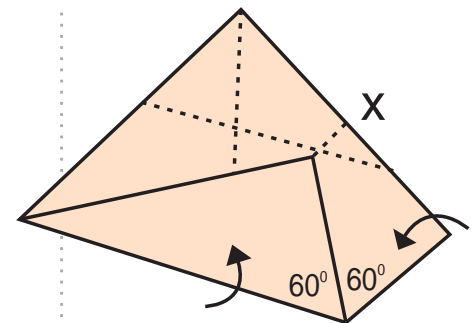
3. This would be the result. This is a wonderful way to crease 60 degree angles.



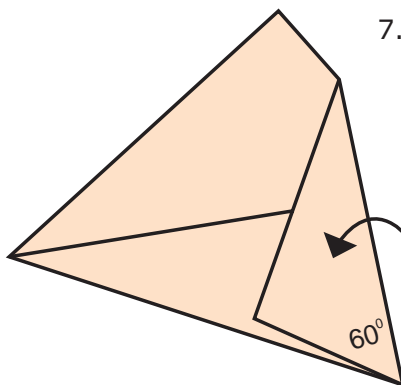
4. Fold the top corner such that its edge sits exactly on top of the left edge.



5. On opening the paper you will find the left-top edge divided into three 60 degree angles.

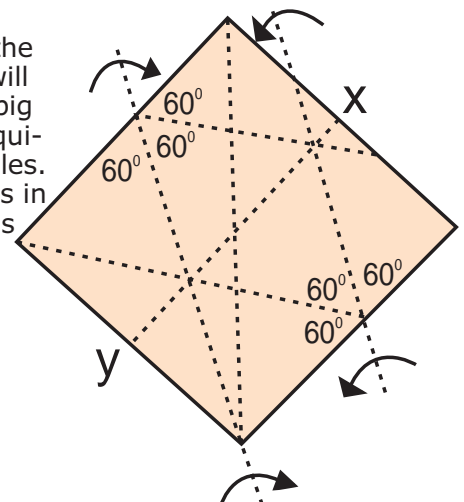


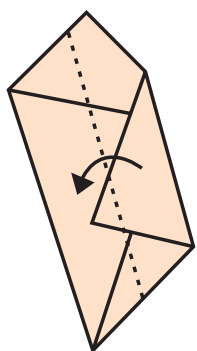
6. Fold the bottom corner and move it on the midline (XY) till the bottom edge passes the left corner. Fold the right corner such that...



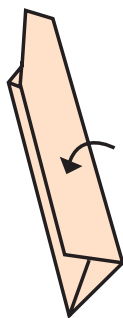
7. ...its edge sits exactly on the top bottom edge.

9. On opening the square you will find several big 60 degree equilateral triangles. Fold two lines in the directions shown...

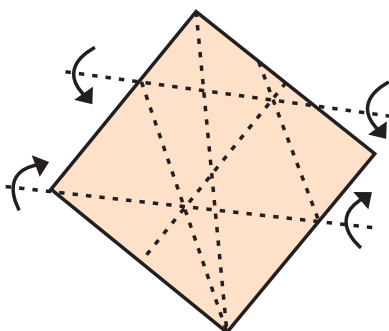




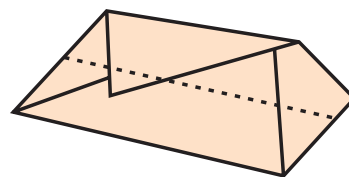
10....to get this shape.



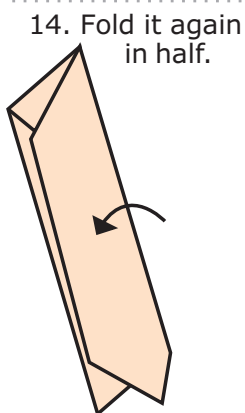
11. Fold it again in half.



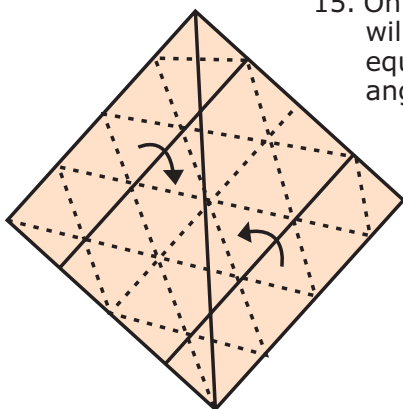
12. Open the square and fold two creases in the directions shown...



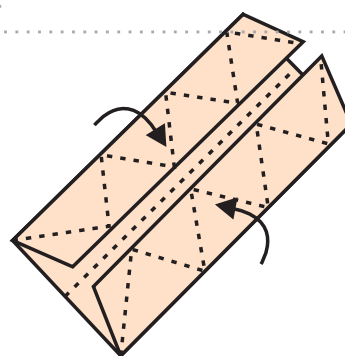
13...to get this shape.



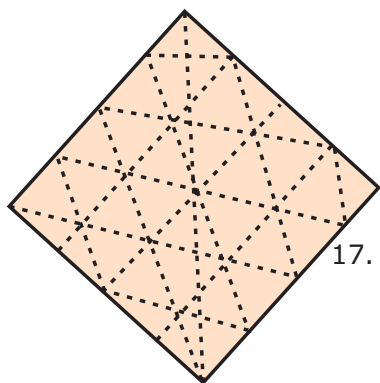
14. Fold it again in half.



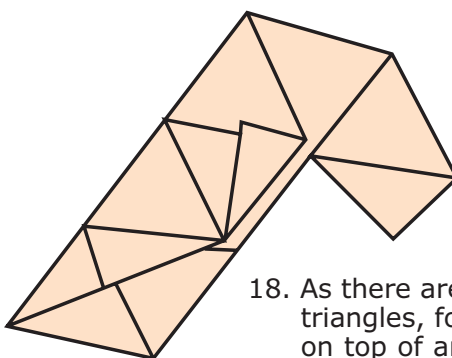
15. On opening you will find a grid of equilateral triangles. Fold the two lines as shown.



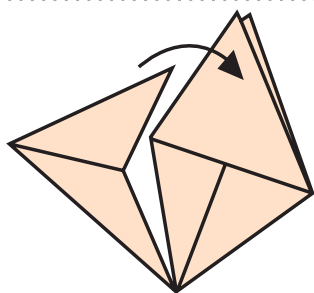
16. To get a rectangular shape.



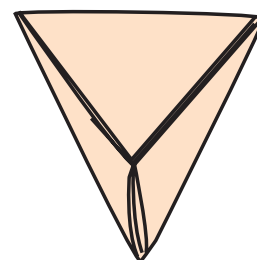
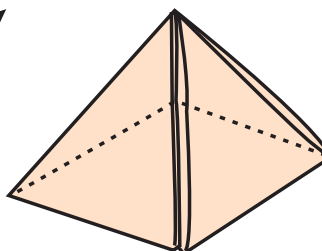
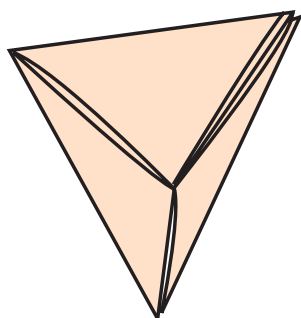
17. On opening the square will be divided into equilateral triangles.



18. As there are too many triangles, fold a crease on top of another to reduce their numbers.



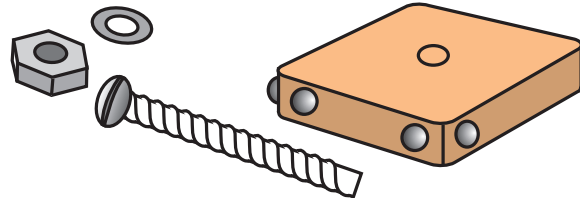
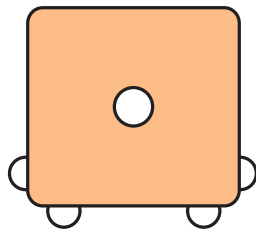
19. Finally assemble a self-locked Tetrahedron, without using any glue or scissors!



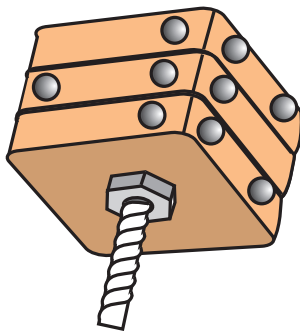
# BRAILLE CUBE

Visually impaired people can learn the Braille language with this wonderful cube. It is being manufactured by a charity *Vidya Vrikshah* based in Chennai and sold for just two rupees!

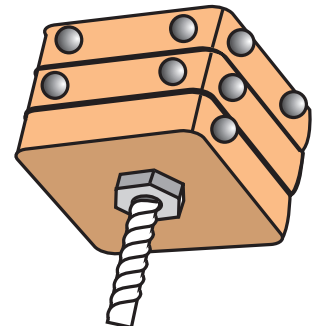
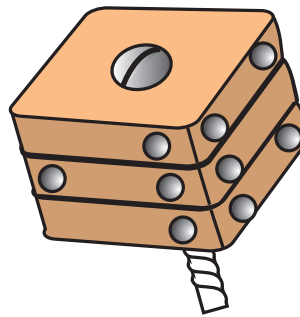
The device is similar to a Rubik's cube, but has different patterns of raised dots on its sides corresponding to the Braille representation of letters in any language. The raised dots appear in one or more of the six positions arranged in three columns of two rows on each side of the cube. The cube consists of three segments which can be rotated about a common axis. Thus different dot patterns corresponding to different letters can be formed on its sides. Thus each letter of the alphabet of any Indian language (or for matter any world language) can thus be represented on any one side of the cube. The dot positions are numbered 1 to 6 and different patterns of dots on the cube and the letters to which they correspond are as seen in the pictures below. With six dot positions, Braille admits of a maximum of 63 dot patterns, more than enough to represent all the letters of any alphabet. All these can be formed on any side of the cube. With a ready chart containing the letters (and their dot patterns) any person can learn the use of the cube within an hour.



Represents W



Represents G

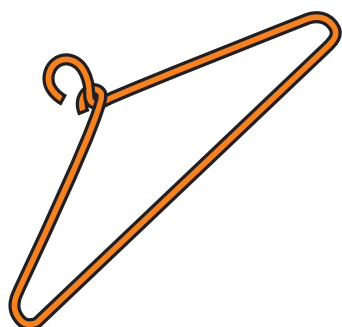


|   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|   |   |   |   |   |   |   |   |   |   |   |   |   |
| a | b | c | d | e | f | g | h | i | j | k | l | m |

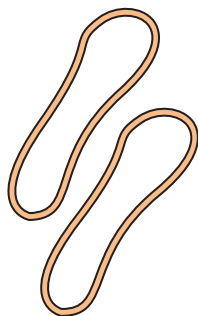
|   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|   |   |   |   |   |   |   |   |   |   |   |   |   |
| n | o | p | q | r | s | t | u | v | w | x | y | z |

# HUMMING HANGER

Using an old hanger and a piece of cardboard, few rubber bands and thread, you could make a 'roarer' or a hummer.

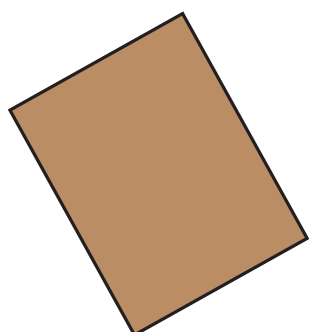
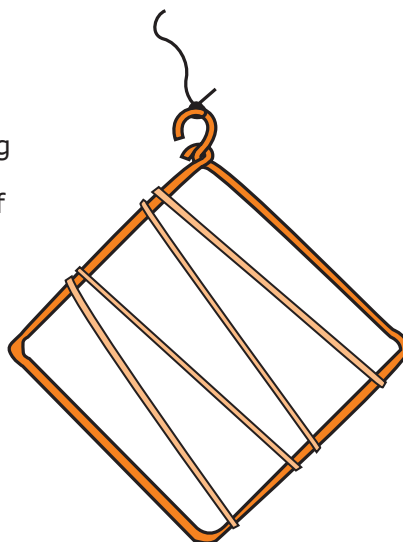


1. Take a wire hanger. Hold the hook with one thumb and pull down the middle point of the big side to make a diamond shape.

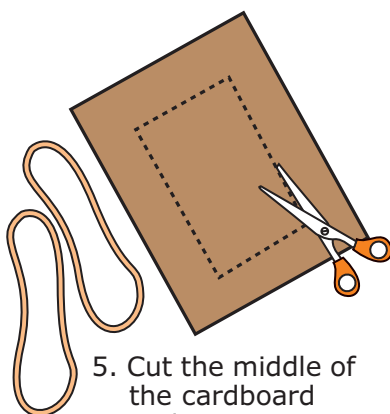


2. Stretch a few rubber bands and slide them on the wire frame.

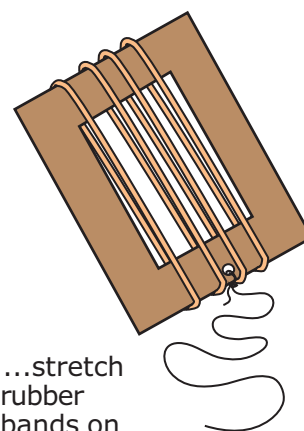
3. Tie a strong thread to the hook of the hanger. Hold one end of the frame and swing the hanger to make a humming noise.



4. Instead of a wire hanger you could repeat this activity with a cardboard frame.

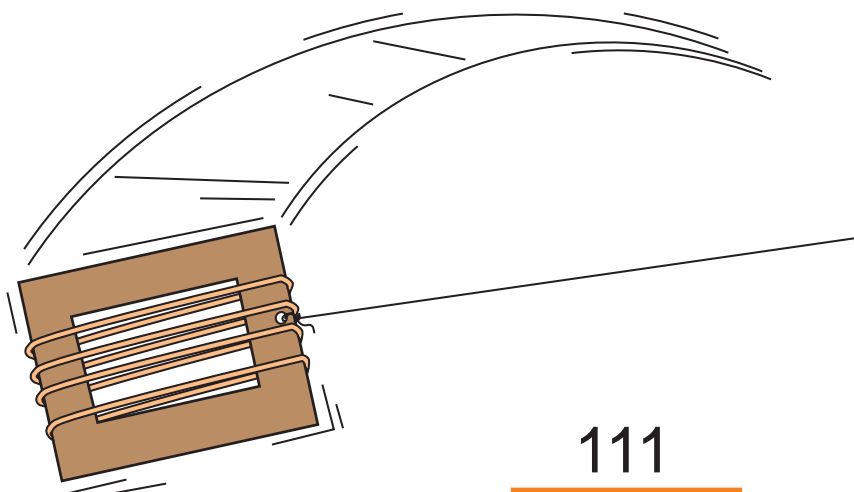


5. Cut the middle of the cardboard and...



6. ...stretch rubber bands on this frame

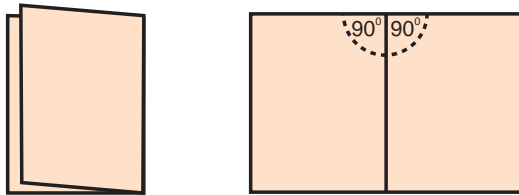
7. Then swing it. What determines the 'hum'? -  
The stretch of the rubber bands.  
The pattern of the rubber bands on the frame.  
The speed of rotation.



# GEOMETRY BY PAPER FOLDING

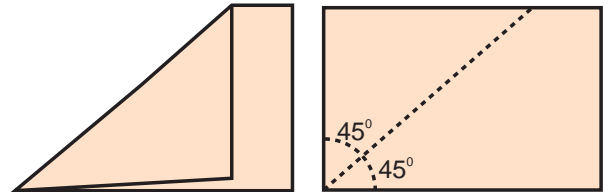
Most of these *Geometric Exercises in Paper Folding* have been inspired by a book of the same name, written by an Indian mathematician in 1893. His name was T. Sundara Row (anglicised from Rao).

## Ninety Degree angle



1. We will start with simple angles. A straight edge is 180 degrees. If we double a straight edge upon itself we get two ninety degree angles.

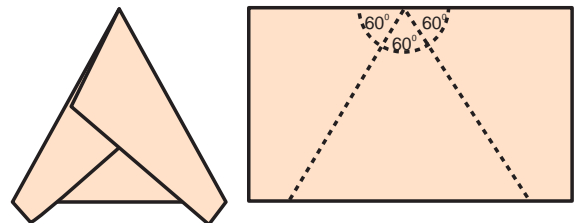
## Forty Five Degree angle



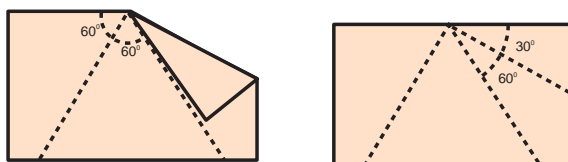
2. A forty five degree angle is got by folding any right angle corner into half.

## 60 degree cone

2. How to fold 60 degrees ? Divide a straight edge (180 degrees) into three equal angles. Take a point mid-way on the straight edge of paper lift both edges of the paper from this point and fold them to approximately 60 degrees. Before creasing ensure that the edges are flush with the folds to be creased

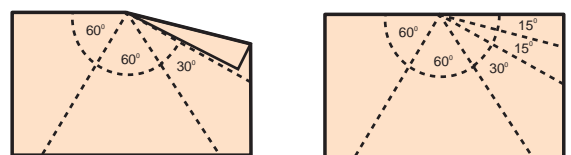


## Thirty Degree angle



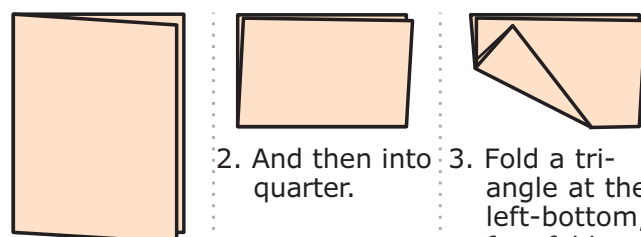
3. Fold the 60 degree angle such that its one edge doubles on the other. It will be divided into two 30 degree angles.

## Fifteen Degree angle



5. A fifteen degree angle can be got by halving the 30 degree angle. This can be done by doubling its one edge on the other.

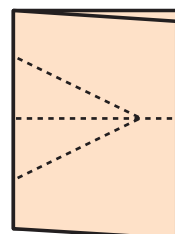
## Paper Diamonds



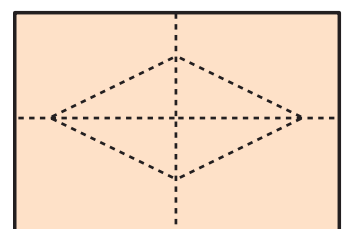
1. First fold a sheet of rectangular paper into half.

2. And then into quarter.

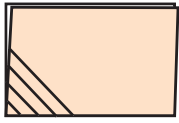
3. Fold a triangle at the left-bottom, four fold corner (the centre of the paper).



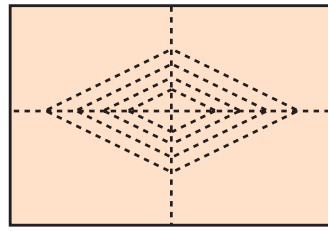
4. On opening one layer you will see half of the diamond.



5. Open fully to see an elegant rhombus in the middle of the paper.



6. If you make several parallel creases at the four fold corner then ...

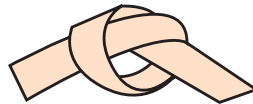


7. ...on opening you will see a diamond in a diamond in a diamond - a series of nesting diamonds or rhombuses.

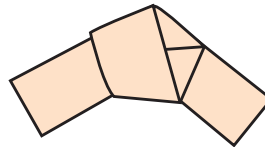
### Knotty Pentagon



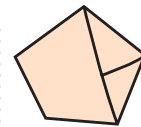
1. Take a long rectangular strip of paper and tie the two loose ends into an ordinary knot



2. Gently pull the ends to tighten the knot.

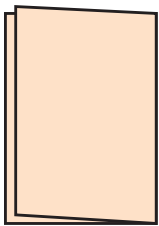


3. Tighten the knot and crease well and you will be surprised to see...

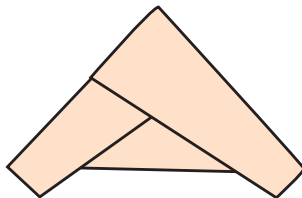


4. a regular PENTAGON.

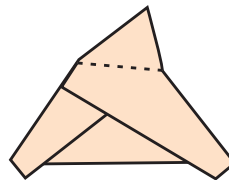
### Regular Hexagon



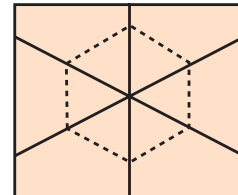
1. Fold a rectangular sheet of paper into half.



2. Fold the doubled up straight edge into three equal parts of 60 degrees each. Crease well.



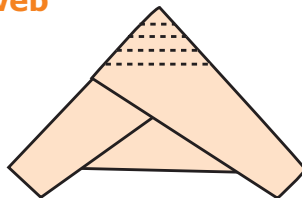
3. There will be 6 layers of paper on the top corner. Fold it into a triangle.



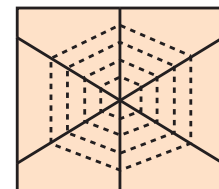
4. On opening you will see a regular HEXAGON in the middle.

### Hexagonal combweb

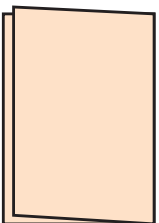
5. If you make several parallel creases at the top corner then....



6. On opening you will see a set of nesting hexagons resembling a cobweb.



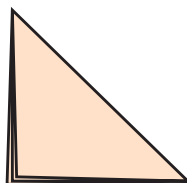
### Octagon



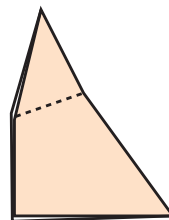
1. Fold a sheet of paper into half and then...



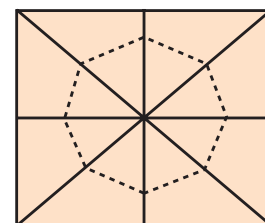
2. into a quarter.



3. Crease the 4 fold corner again into a triangle to make 8 folds.



4. Crease the 8 fold corner sharply.

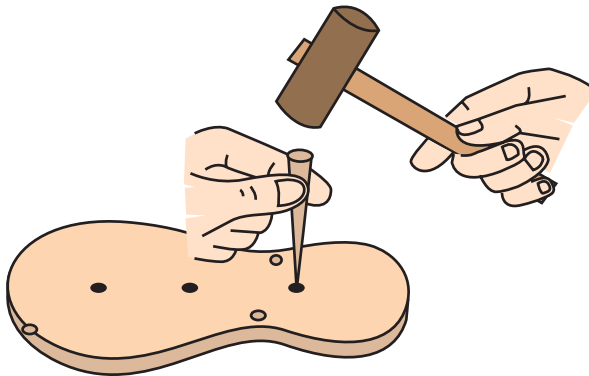


5. On opening you will find a regular OCTAGON in the centre.

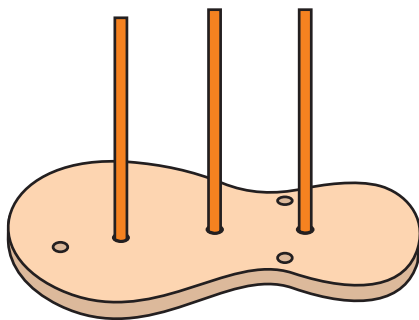


# PLACE VALUE / DECIMAL POINT

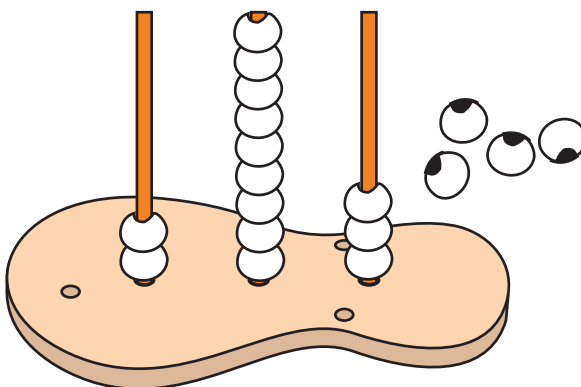
## SLIPPER ABACUS



1. Take an old rubber slipper. Make three 7-8 mm diameter holes on its midline using a shoemaker's punch.

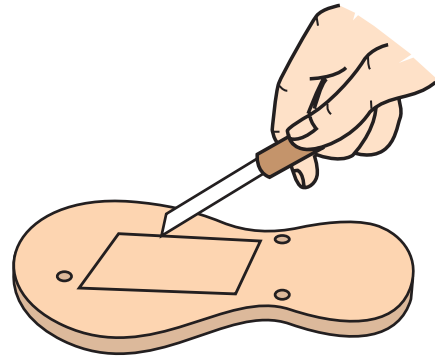


2. Insert / press fit a pencil / reed in these holes. The height of the pencil should be only 9 beads high.

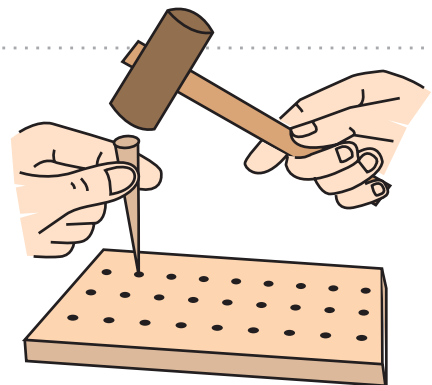


3. This simple abacus can be used to show place value. The number 293 is denoted on it.

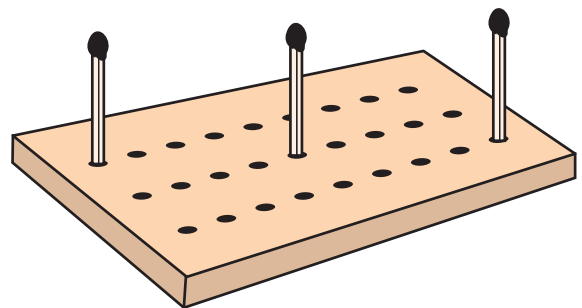
## RUBBER ABACUS



1. Cut a 5 cm x 10 cm piece from an old hawai chappal.



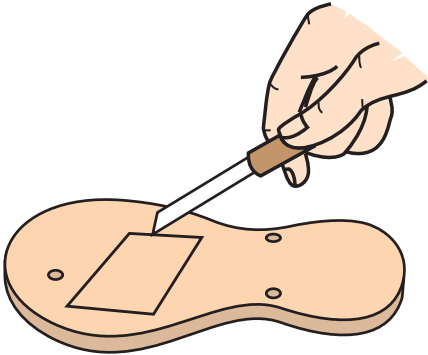
2. Mark out 3 columns and 9 rows of dots on it. Punch holes on the dots using a 2mm shoemaker's punch.



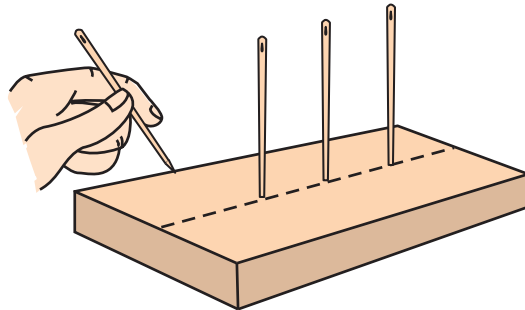
3. Using matchsticks you can depict any score from 0 to 999 on this counter. The score right now is 159.



# DECIMAL ABACUS

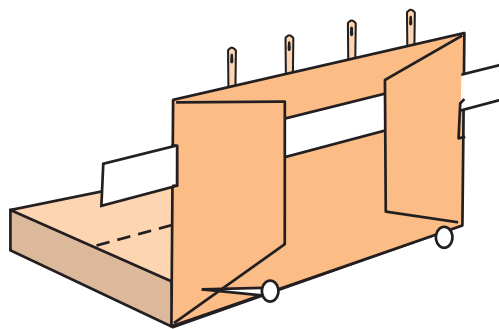
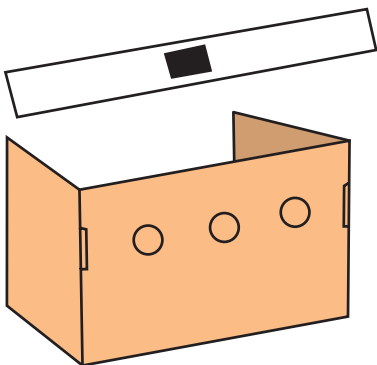


1. Cut a 6 cm x 3cm piece from an old rubber slipper.

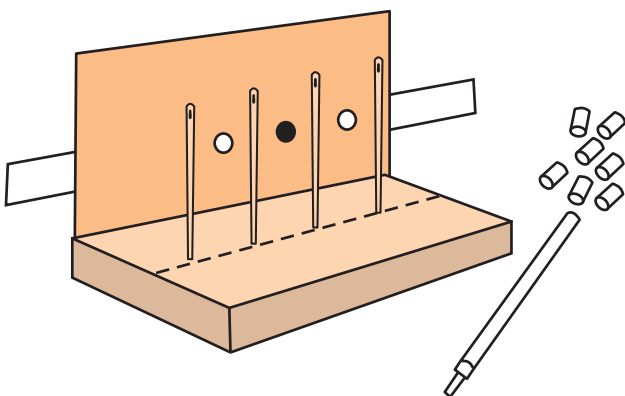


2. Stick 4 needles in the rubber so that they are 4.5 cm above.

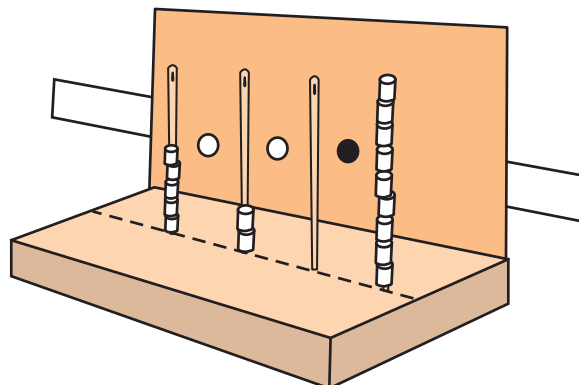
3. Cut a 6 cm x 6 cm piece of old postcard. Make 3 holes and 2 slits on it. Mark a black spot on another postcard strip.



4. Attach the postcard piece to the rubber with pins. Weave the strip through the slits.

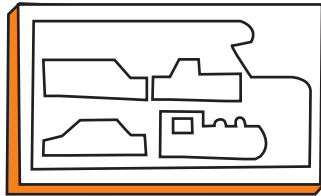


5. Cut 5 mm long beads from an old refill.

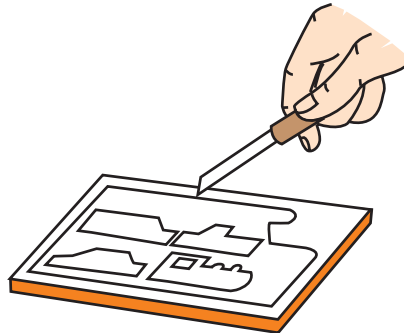


6. The abacus indicates 520.9. It has got a sliding decimal point.

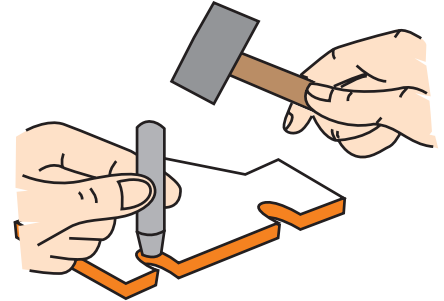
# MOTHER TRUCK



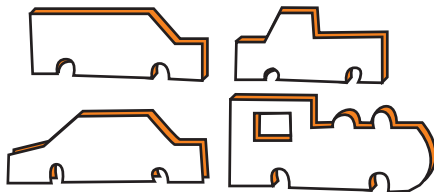
1 Take a 20 cm x 30 cm piece of shoe sole rubber (about 8 mm thick). Mark out different vehicles - engine, car, jeep and van on it.



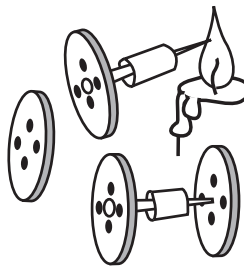
2. Cut these shapes with a sharp knife.



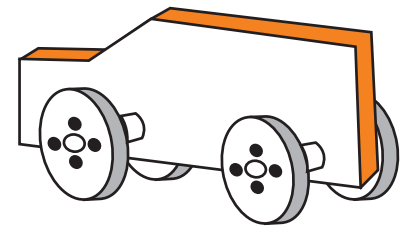
3. Using a shoe maker's punch make two holes of 8 mm diameter near the base of each vehicle.



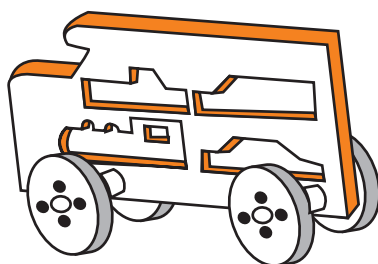
4. The finished rubber cars will look like this.



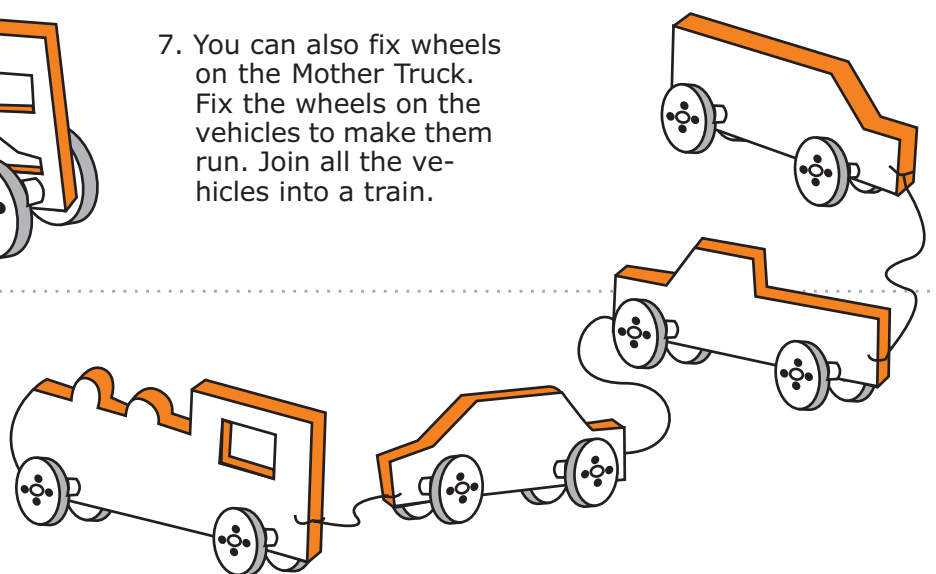
5. Make several button wheel pairs. Use 1.5 cm long pieces of a ball-pen body as bearings.



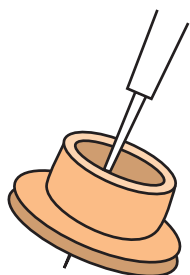
6. These pieces will snap into the holes of the rubber vehicles. You can fix or remove the wheels at will.



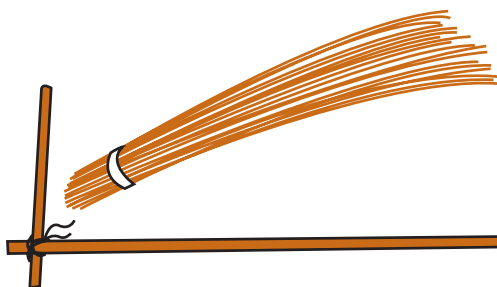
7. You can also fix wheels on the Mother Truck. Fix the wheels on the vehicles to make them run. Join all the vehicles into a train.



# SUDARSHAN CHAKRA

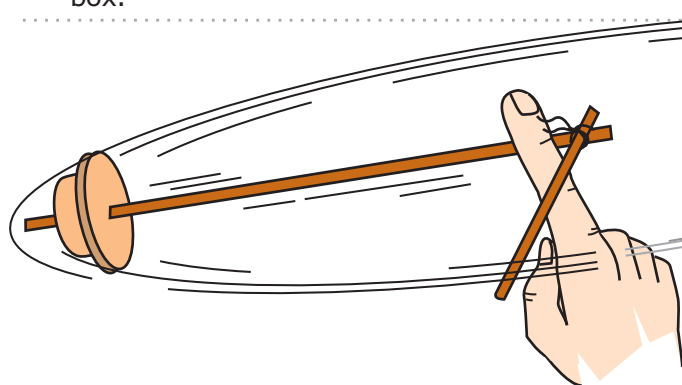
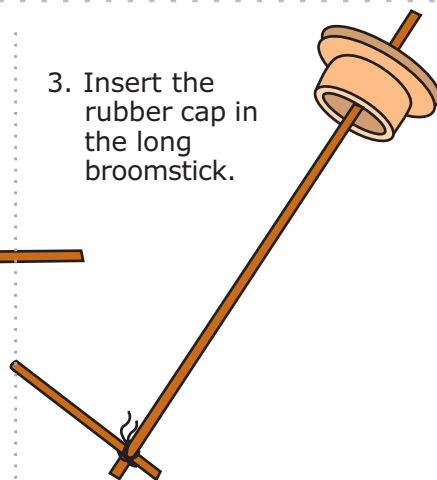


1. Poke a hole in the rubber cap of an injection bottle, or else, in the eraser from your geometry box.



2. Cut two sticks from a broomstick- one long 15 cm and the other short 6 cm. Tie the sticks tightly with a string as shown in the drawing.

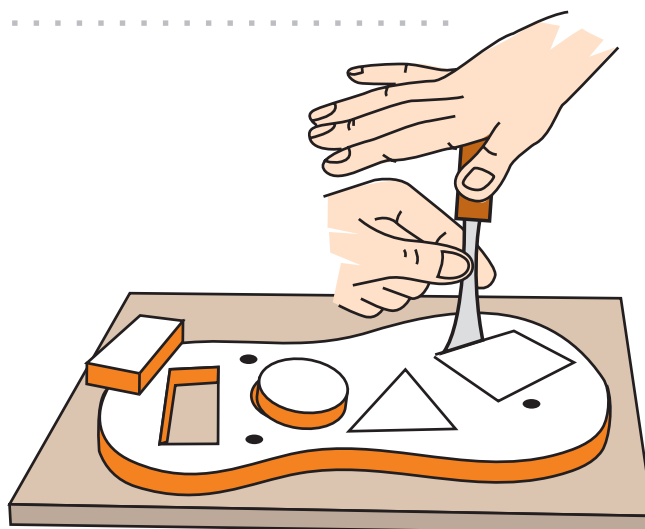
3. Insert the rubber cap in the long broomstick.



4. Now place the joint of the sticks on your right hand index finger and rotate the assembly as shown. You will be surprised to see that the sticks rotate around your finger like a Sudarshan Chakra without falling. As a matter of fact, the faster you rotate the sticks, the more stable and balanced is the assembly. This simple toy will give children a good feel for Centrifugal and Centripetal force.

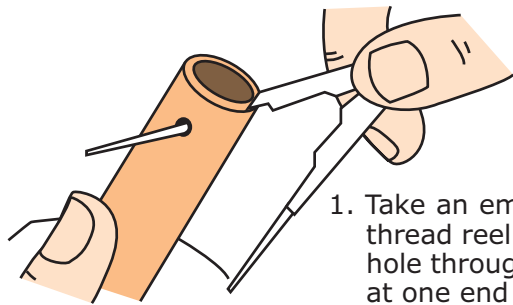
## ZERO-COST INSET PUZZLES

Old rubber slippers are great for making Montessori Inset Puzzles. Take an old rubber "Hawai" slipper and scrub it clean with soap. Mark out some geometric shapes on the slipper with a pen. Keep the slipper on a wooden board and cut the shapes using a shoe maker's knife (rampi). Round circles are best cut by hammering a sharpened pipe on the rubber. Rubber slippers have no sharp points so they cannot hurt children and are safe. The rubber blocks fit snugly into their slots. The inset blocks are white above and blue below. If you upturn them then the blue block stand out clearly on the white background. So, there is no need to paint them.



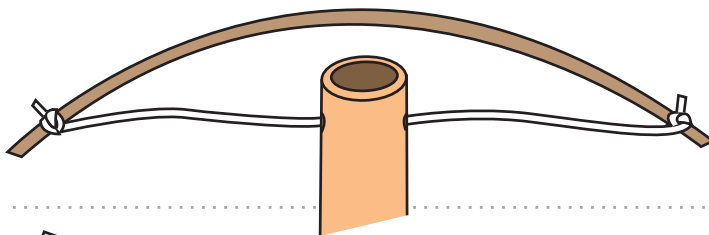
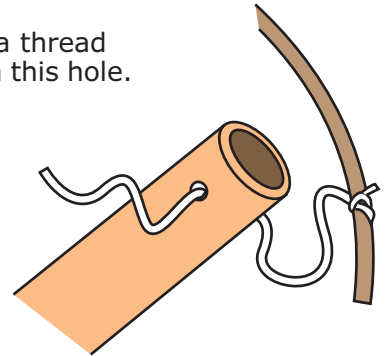
# BIRD IN A CAGE

We see things with our eyes. But we continue to see a thing for a little while longer even after it has been removed from sight. This is called persistence of vision. The principle of the bow-drill, still in use by carpenters can be incorporated into an ingenious folk toy to demonstrate the persistence of vision.

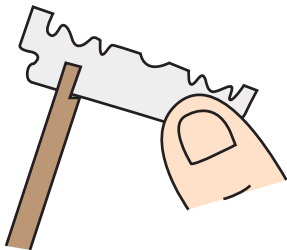


1. Take an empty cotton thread reel. Make a hole through the reel at one end using a divider point.

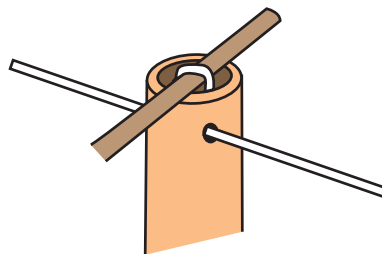
2. Weave a thread through this hole.



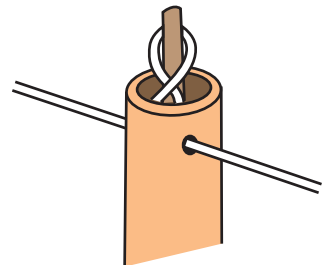
3. Tie the two ends of the thread to the two ends of a strong coconut broomstick bent into an arc. The bow-string should be slightly loose.



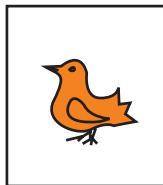
4. Take a 10 cm long reed from a *phooljhadu* (broom) and split it at one end for about 1 cm in length.



5. Insert the other end of the reed inside the reel and remove out the thread.

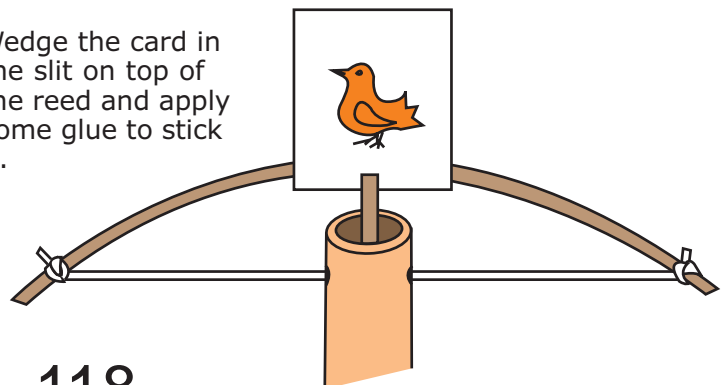


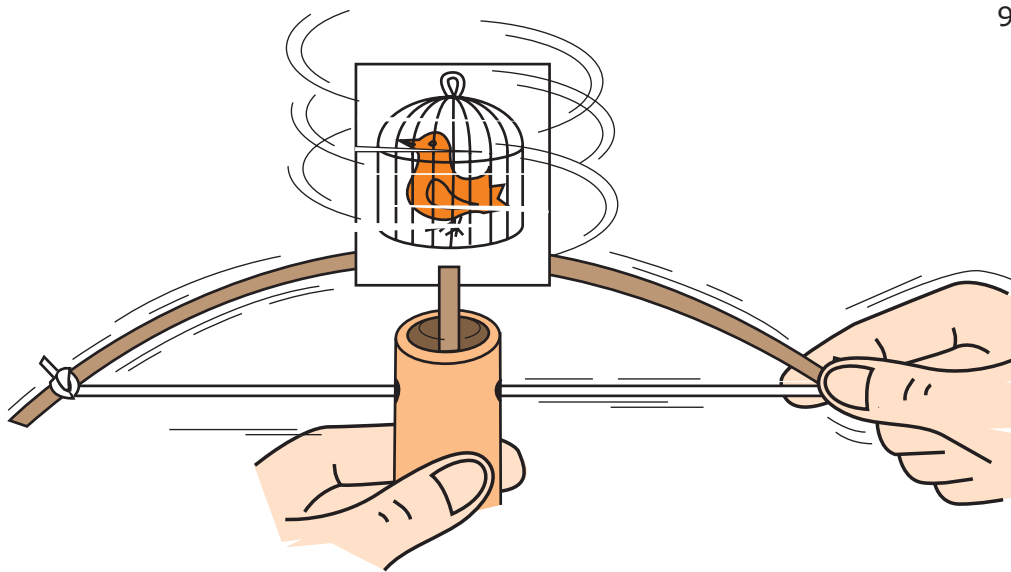
6. Rotate the reed by 180 degrees and insert it inside the reel so that the thread loops once around the reed.



7. Make a bird and a cage on either side of a 3 cm. square card sheet.

8. Wedge the card in the slit on top of the reed and apply some glue to stick it.





9. Hold the thread reel with the left hand and move the bow to and fro with the right hand. The reed will turn round and round and the bird will appear to be engaged. The bow drill is a beautiful mechanism. It converts the straight-line motion of the bow, into the rotary motion of the reed.

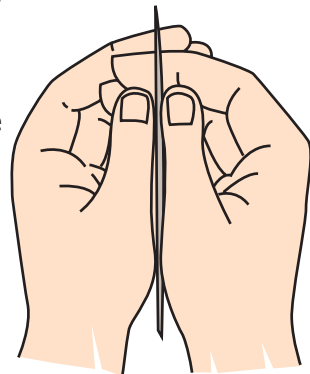
## WHISTLE

This is a very simple way to make a very loud whistle.  
For making it you just need a clean blade of grass.

1. Cup your hands together, with your thumbs facing you. Place the clean blade of grass in the space between your thumbs. (You may have to take someone's help to put the blade of grass).



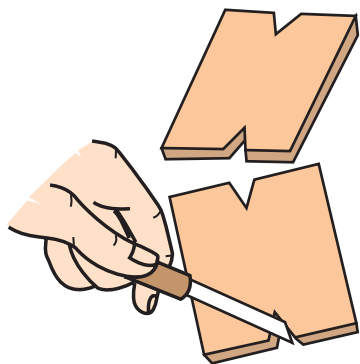
2. The blade of grass has to be held very tightly in place by the tip and base of each thumb.



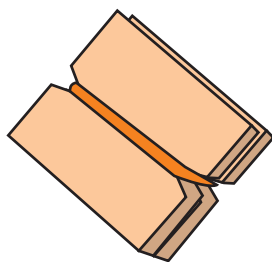
3. Bring your hands close to your lips. Blow into the space between your thumbs so that the blade of grass starts to vibrate. The vibrating blade will produce a shrill whistle like sound.

# CLAP IN THE AIR

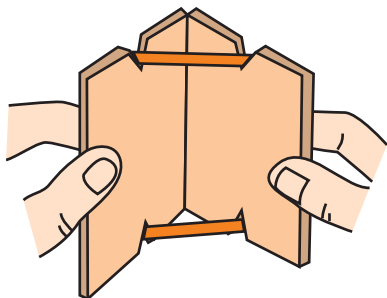
Generations of children have made this simple toy and enjoyed playing with it.



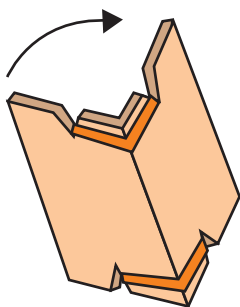
1. Take two cardboard squares of edge 6 cm. Cut V notches in the middle of two opposite sides.



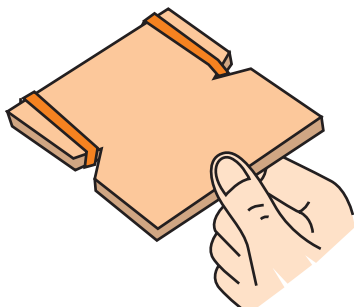
2. Place one piece on top of the other. Align the notches and place a rubber band in its groove.



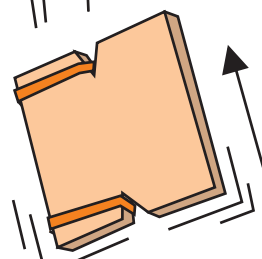
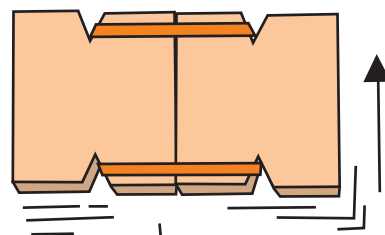
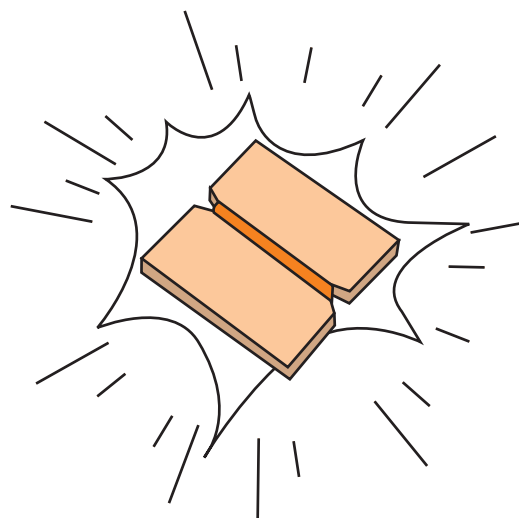
3. Now open the cardboard pieces with both the thumbs and fold them in the reverse direction.



4. This stretches the rubber band and keeps it in tension.



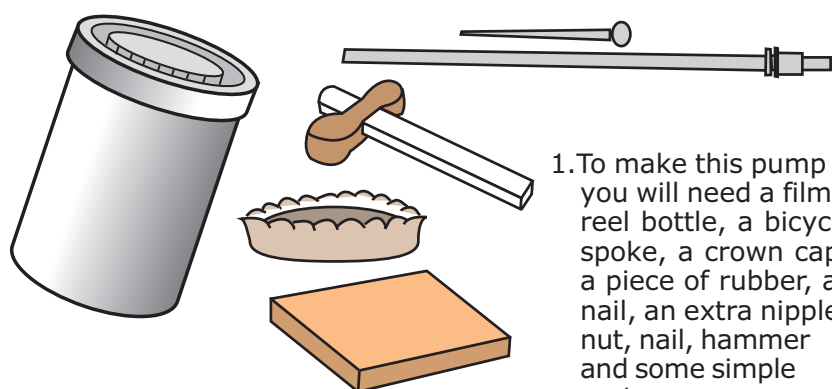
5. Now throw these refolded cardboard pieces upwards.



6. You will hear a nice clap in the air.

# FILM BOTTLE ROTARY PUMP

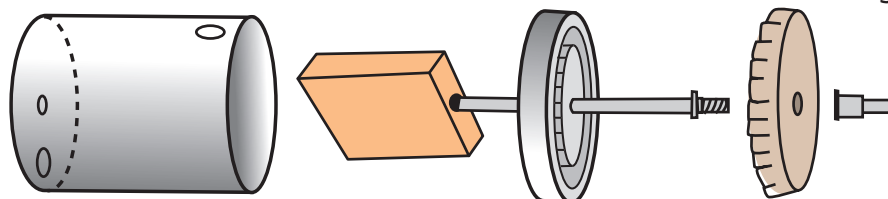
This pump is like the pump, which is used to draw out water from the well. The crown cap of this pump is pressed to a cycle tire, which rotates it fast and water gushes out.



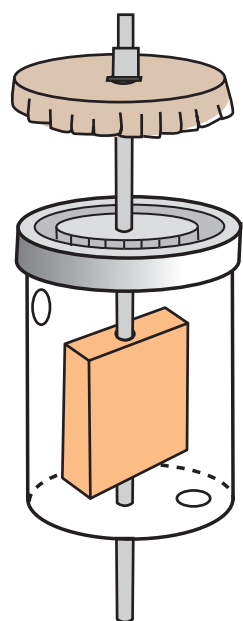
1. To make this pump you will need a film reel bottle, a bicycle spoke, a crown cap, a piece of rubber, a nail, an extra nipple nut, nail, hammer and some simple tools.



2. With the help of a nail, hammer a small hole in the center of the crown cap.

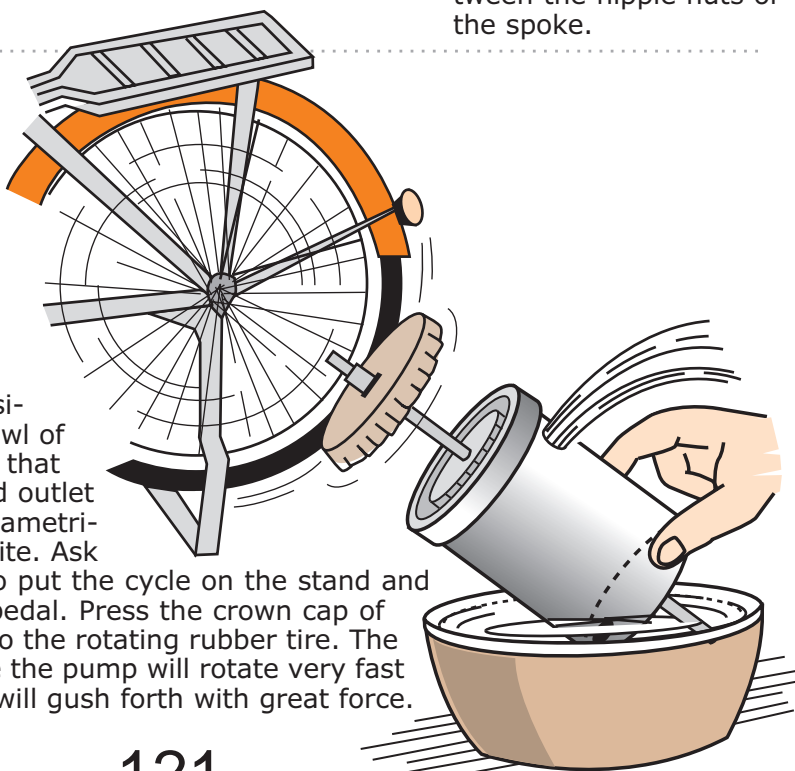


3. Make three holes in the film reel bottle and one in its cap as shown. Attach the rubber rotor to the spoke. The rubber rotor must move freely inside the bottle cylinder. Fix the soda water bottle, crown cap tightly between the nipple nuts of the spoke.



4. This is complete assembly of the film bottle rotary pump.

5. Keep the pump in an inclined position in a bowl of water, such that its inlet and outlet ports are diametrically opposite. Ask someone to put the cycle on the stand and crank the pedal. Press the crown cap of the pump to the rotating rubber tire. The rotor inside the pump will rotate very fast and water will gush forth with great force.





# THUMBPRINTS

Thumbprints can be amazing fun. Try some!

Of all the little  
things we seek.  
Our thumb appears,  
to be unique.

Have you seen  
your own thumbprint?  
It has a  
unique imprint.

No two thumbprints,  
look the same.  
But they make a  
very good game.

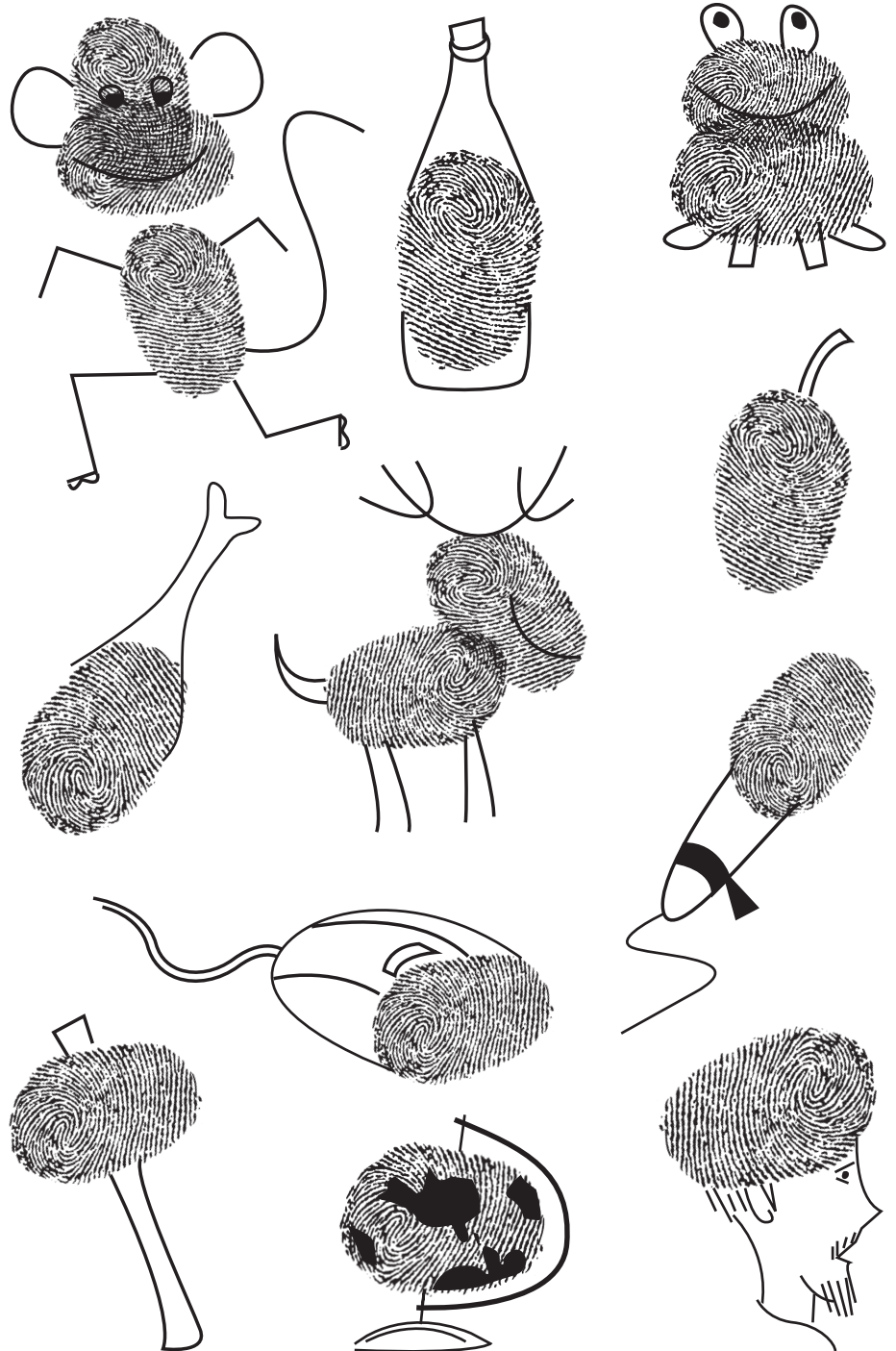
Six billion people,  
throng the globe.  
Each with a unique  
thumb lobe.

Every thumbprint,  
in the world,  
Has different lines,  
different whorls.

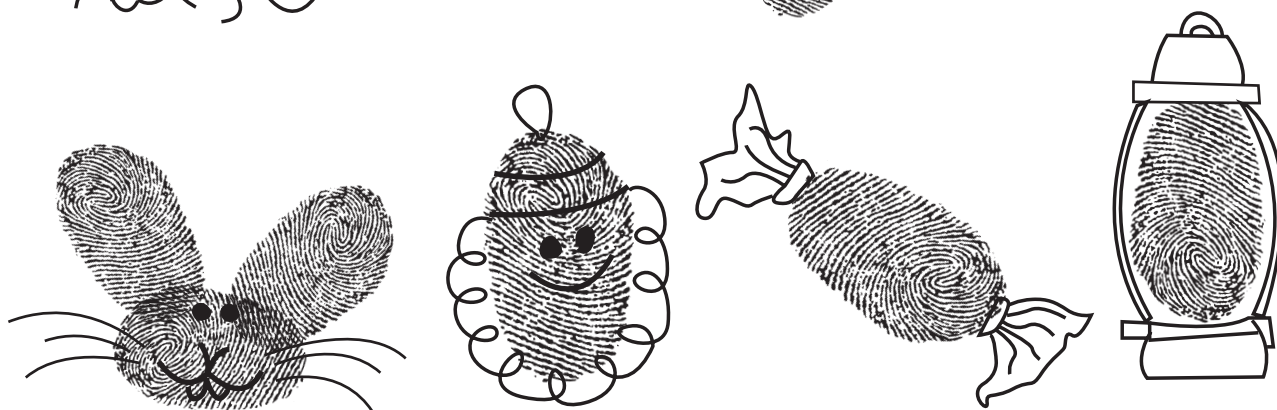
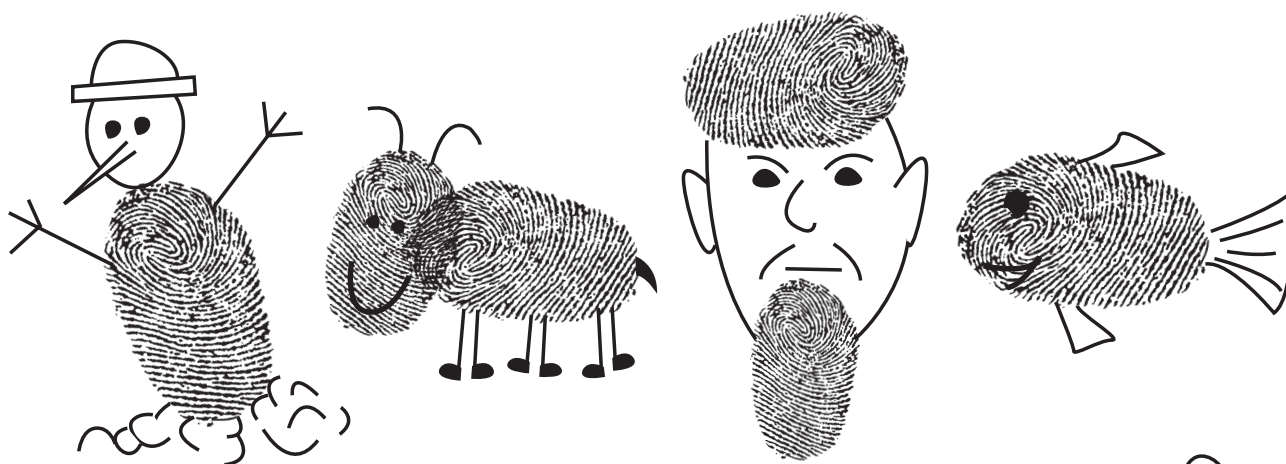
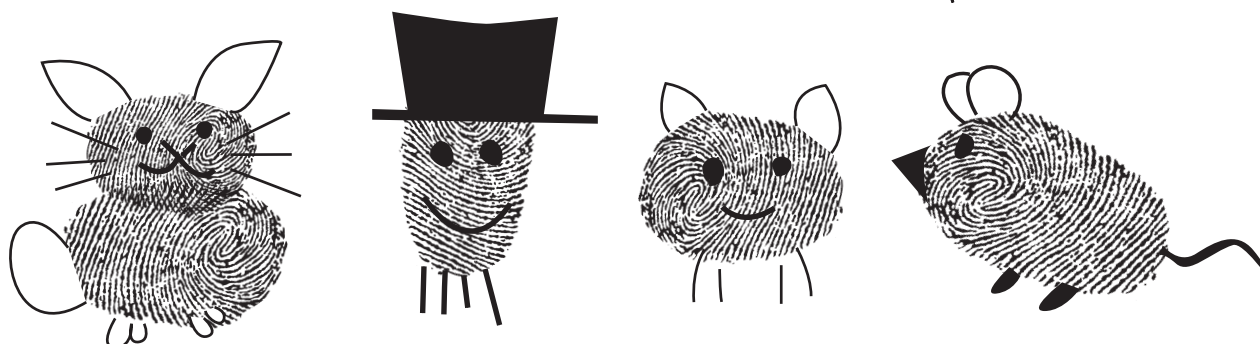
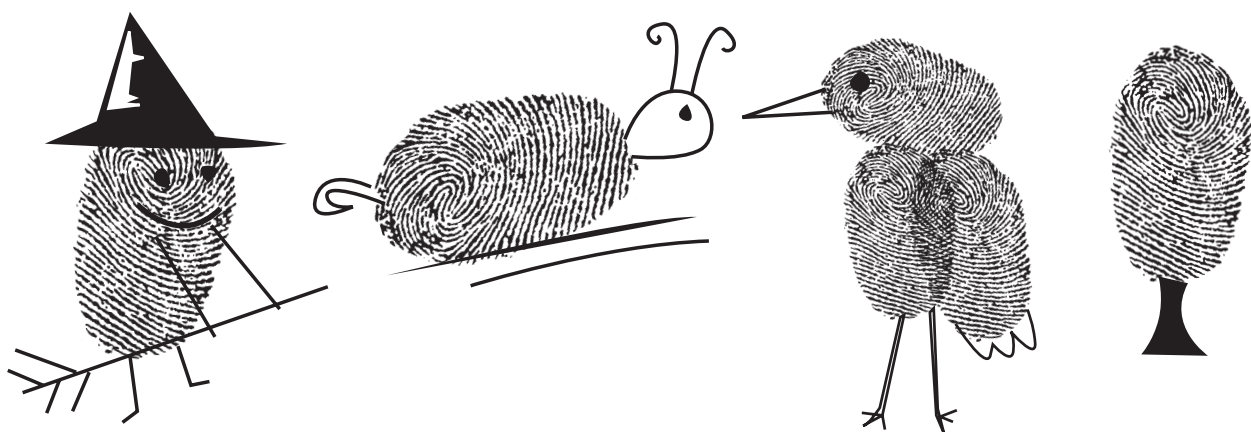
Print your thumb,  
look up or down.  
You might find,  
in it a clown.

A bird, a lion,  
a crawling snail.  
A fish, a peacock,  
snorting whale.

In your thumbprint,  
you will find.  
Lots of things,  
to open your mind.









## ARVIND GUPTA

Graduated from IIT, Kanpur (1975) and worked with TELCO, Pune for a few years. In 1978, he took one year's study leave from TELCO to work with the grassroots village science teaching programme for children in the tribal district of Hoshangabad, Madhya Pradesh. While working there he developed many useful low-cost science teaching aids using locally available materials. The possibilities of using ordinary things for doing science and recycling modern junk into joyous toys appealed immensely to children. His first book ***Matchstick Models & Other Science Experiments*** was translated into 13 Indian languages and sold more than half a million copies. He has written 14 books and translated over 100 books on science, environment, and education into Hindi. He has conducted hands-on workshops for children and teachers in over 1200 schools across the country and presented over 102 TV programmes on science based fun activities, innovative toys and teaching aids on national television. These films have been made by the NCERT and the UGC for the countrywide classroom broadcast.

### Recognition

Arvind Gupta's outstanding contributions in designing science teaching aids for young children have been recognized by several international organizations such as UNICEF, UNESCO, International Toy Research Association, Boston Science Centre, MIT (Media Lab) and the International Play Association.

### Awards

Arvind Gupta has received several awards. These include the inaugural National Award for Science Popularization amongst Children (1988), Hari Bhau Mote Award of the Marathi Vigyan Parishad (1988), the Distinguished Alumnus Award of IIT, Kanpur (2000 and the Indira Gandhi Prize for Science Popularization (2008).

### **Books written by Arvind Gupta**

1. **Aha! Activities** (2006) – *Eklavya Publication, Bhopal*
2. **Hands-On** (2004) – *Vigyan Prasar*
3. **String Games** (2002) – *National Book Trust*
4. **Ten Little Fingers** (2000) – *National Book Trust*
5. **Little Toys** (1996) – *National Book Trust*
6. **Toy Treasures** (1993) – *Eklavya Publication, Bhopal*
7. **Toy Joy** (1992) – *Vigyan Prasar*
8. **Pumps from the Dump** (1992) – *Vigyan Prasar*
9. **Leaf Zoo** (1992) – *Vigyan Prasar*
10. **The Toy Bag** (1991) – *Eklavya Publication, Bhopal*
11. **Tangram** (1990) – *Balsahiti, Hyderabad*
12. **Little Science** (1989) *Translated and printed in six Indian languages*
13. **Matchstick Models & Other Science Experiments** (1987)  
*Selected under Operation Blackboard by six State Governments.*
14. **Kalikkam Padikkam** (2007) *Kerala State Institute of Children's Literature.*





## ARVIND GUPTA

Graduated from IIT, Kanpur (1975) and worked with TELCO, Pune for a few years. In 1978, he took one year's study leave from TELCO to work with the grassroots village science teaching programme for children in the tribal district of Hoshangabad, Madhya Pradesh. While working there he developed many useful low-cost science teaching aids using locally available materials. The possibilities of using ordinary things for doing science and recycling modern junk into joyous toys appealed immensely to children. His first book ***Matchstick Models & Other Science Experiments*** was translated into 13 Indian languages and sold more than half a million copies. He has written 14 books and translated over 100 books on science, environment, and education into Hindi. He has conducted hands-on workshops for children and teachers in over 1200 schools across the country and presented over 102 TV programmes on science based fun activities, innovative toys and teaching aids on national television. These films have been made by the NCERT and the UGC for the countrywide classroom broadcast.

### Recognition

Arvind Gupta's outstanding contributions in designing science teaching aids for young children have been recognized by several international organizations such as UNICEF, UNESCO, International Toy Research Association, Boston Science Centre, MIT (Media Lab) and the International Play Association.

### Awards

Arvind Gupta has received several awards. These include the inaugural National Award for Science Popularization amongst Children (1988), Hari Bhau Mote Award of the Marathi Vigyan Parishad (1988), the Distinguished Alumnus Award of IIT, Kanpur (2000) and the Indira Gandhi Prize for Science Popularization (2008).

BEST OF ARVIND GUPTA

# SCIENCE

## SKILLS & THRILLS



"Where is the money to buy science kits? With sixty children doing experiments, I will go bonkers.."

Serious teachers have always raised such questions. With paucity of funds and poor infrastructure - how does one do justice to activity based science?

But inspired teachers have faith in the resources and resilience of children. They know that 'activities' constitute great learning and children love them. The models the children and teachers make themselves remain more enduring. There are amazing possibilities of doing creative science using simple, readily available materials.

Shri Arvind Gupta after his graduation from IIT Kanpur, devoted his life for science education in schools in India. He has developed a number of models for promoting and popularising activity based science teaching. This book unfolds the amazing world of creative models and toys that even the poorest child can make and develop a lot from the junk around him.

This is a collection of shri Arvind Gupta's best writings from his 13 books.



**KERALA STATE INSTITUTE OF CHILDREN'S LITERATURE**

**ISBN 978- 81- 906266- 1-3      KSICL 562/E1      Rs. 100.00**